DIMENSIONS NBS

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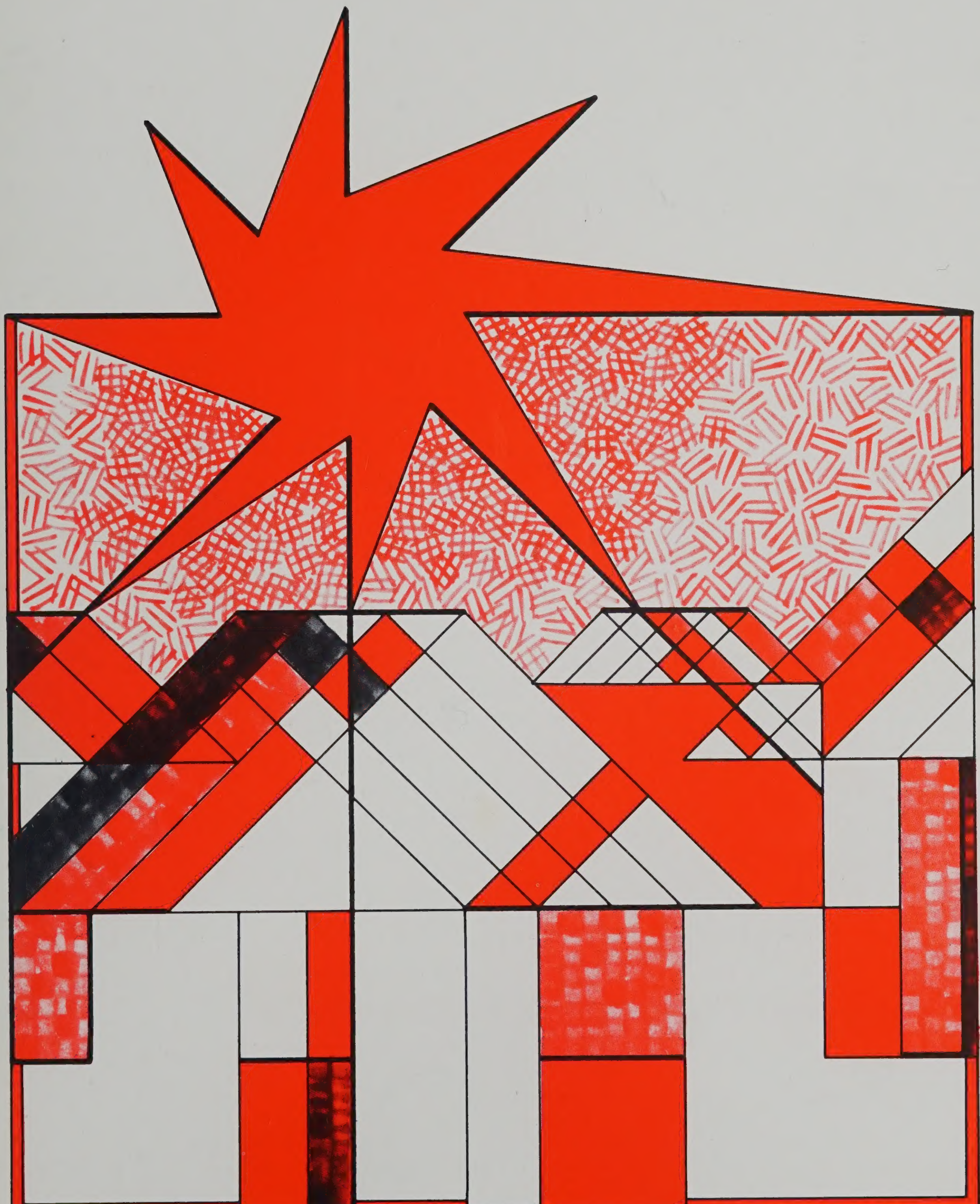
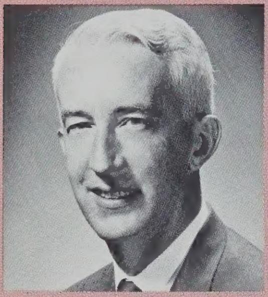


PASSIVE SOLAR TECHNOLOGY. See page 8.

COMMENT

RADIATION IN CONTEXT



Radiation, meaning "ionizing radiation" such as x-rays, gamma-rays, alpha-rays, beta-rays, and neutrons, is often regarded as mysterious, or perhaps frightening. This uneasiness may stem in part from our inability to see, hear, feel, touch, or smell radiation. However, with proper instruments and know-how, it is easy to detect the presence of radiation and to measure it quite accurately.

We have lived with radiation since before we were born. Natural radiation comes from cosmic rays, from soil, water, construction materials, and even from radioactive potassium in our body. Ionizing radiation, like other phenomena such as fire and water, is both good and bad. Let us consider this further.

How is radiation useful to mankind? A most important area is in medicine. Medical diagnosis uses two general techniques: x-rays and a relatively new discipline called nuclear medicine (radioisotope scans). Probably the most exciting development in x-rays since they were discovered is the CT (computed tomography) scanner, which has provided a new and excitingly different means of viewing organs inside the body.

Radiation, surgery, and chemotherapy can all cure cancer, but unfortunately, not always. However, cure rates do show a slow but steady increase. Of particular interest are combinations of the three major methods of cancer treatment—combining radiation with surgery, or combining chemotherapy and radiation—to achieve higher cure rates than either method used alone.

Radiation is intimately associated with energy production from nuclear fission and fusion, both very large potential sources of long-term energy for mankind. While both technologies pose problems, including confinement of fission-product radiation (fission) and tritium radiation (fusion), the amounts of energy available are virtually inexhaustible as compared with coal and oil.

Radiation serves as a probe of the universe from the very large (astronomical) scale to the very small (subnuclear) scale. Between these extremes, radioactive tracers and neutrons are powerful and unique probes of the processes of biological systems and of the structure of matter. Among many other applications are those of improving the quality of many products of industry. Sterilization of medical sutures and bandages and improvement of the properties of the plastic insulation coating of wires are two important examples.

On the other side of the balance sheet, radiation can produce undesirable biological effects. One class of effects is called "somatic" effects such as cancer induction or radiation sickness. The other class of effects is genetic which, through the induction of mutations by radiation, could affect future generations. Although we probably know more about radiation effects than about similar effects of other environmental agents, such as chemical toxins, we do need more research for increased understanding of the biological effects of ionizing radiation. This is particularly true in the low-dose region, where the effects are so infrequent as to be difficult to correlate with the radiation received.

Some thoughts have come to mind that seem to me to warrant consideration: 1) No increment of radiation exposure above natural background should be accepted without some accompanying benefit. 2) Technology should be used to increase the benefit from radiation while decreasing the risk. I can think of many opportunities for this, such as the use of heavy-particle radiations (neutrons and alpha-particles) in radiation therapy; development of chemical protective agents against radiation; use of modern imaging techniques to reduce patient dose in x-ray diagnosis; improvements in nuclear-reactor safety technology and development of the inherently safer fusion-energy technology. 3) There is need for a broad-gauged national research program on the biological effects of ionizing radiations. 4) The development and dissemination throughout the Nation of a reliable, verified measurement system for radiation is needed.

In particular, the last two elements, combined with careful radiation management, could go a long way toward building the public confidence needed for the beneficial use of radiation in our society. The recommendations presented in the Report to the Senate on "Ionizing Radiation" (excerpted in this issue) are in accord with this philosophy.

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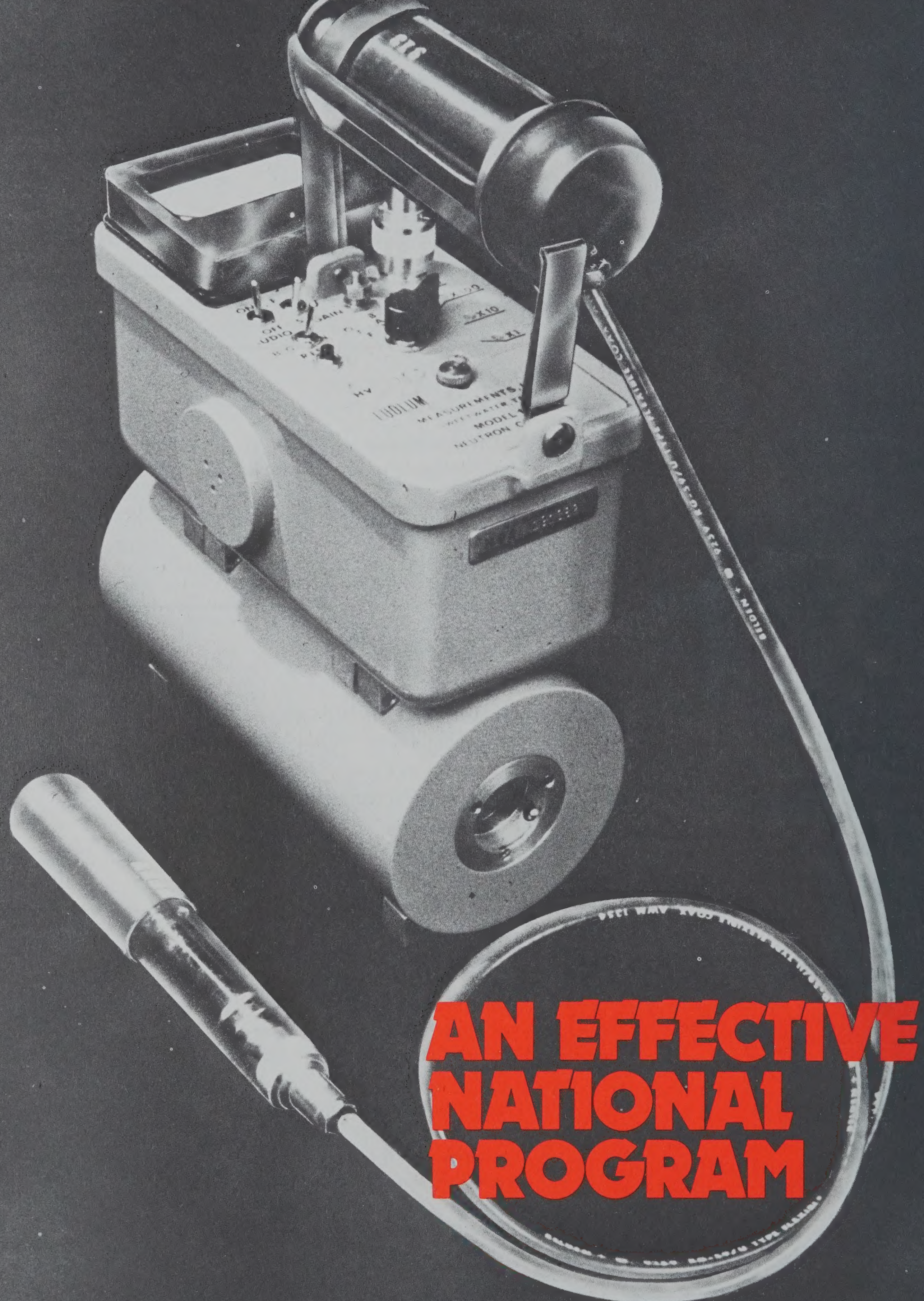
Contents

ARTICLES

INTERFACE

UPDATE



AN EFFECTIVE NATIONAL PROGRAM

Recommendations for Ionizing Radiation Measurements

IN a report issued in December 1978, the U.S. Senate Committee on Commerce, Science and Transportation recommended that the National Bureau of Standards, in cooperation with the Conference of Radiation Control Program Directors (CRCPD), review the network of standards laboratories, regulatory agencies, and voluntary organizations responsible for assuring the accuracy of radiation measurements made in the United States. Specifically, the committee was interested in the need for establishing an intermediate level of calibration laboratories to "better couple NBS laboratories with State and industrial needs." This article is excerpted from the recently released NBS report of that study.

Ionizing radiation refers to any type of radiation that, as a result of physical interaction, can cause atoms or molecules to lose (or gain) one or more electrons and thereby become ionized. X-rays, electrons, neutrons, gamma rays, beta rays, alpha particles, and pi mesons are examples of ionizing radiation. The increase in applications of ionizing radiations has resulted in numerous regulations intended to protect the public from potential radiation hazards, and compliance with these regulations is generally determined by measurement of radiation levels. However, reliable measurements have been demonstrated for only a fraction of the ever-increasing uses of and human exposures to ionizing radiation.

Radiation is used not only in hospitals for diag--nosis and therapy but also in industry for sterilizing products, curing plastics, inspecting products, and a variety of other applications, including the production of energy. Also of some concern are the many natural and artificial sources of radiation found in the environment.

Currently, 19 Federal agencies have some radiation health and safety authority, and over 100 statutes pertaining to radiation protection regulations have been passed by the States. The effective and equitable enforcement of these regulations requires measurements that are reliable, uniform, and sufficiently accurate for each case. Uniformity of measurements is important to avoid conflicts between regulators and those subject to the regulations.

Such uniformity and accuracy can be achieved when all the measurements are made in terms of the national physical measurement standards maintained by NBS. This is done through calibration programs and measurement quality assurance tests, which check the uncertainty not only of measurement instruments but of the entire measurement process and provide the route by which field measurements can be traced to national standards.

Left. Simple survey instrument for thermal and fast neutrons. BF_3 tube senses thermal neutrons. When placed in cylindrical moderator, instrument responds to fast neutrons.

Measurement Needs vs. Present Capabilities

Accuracy requirements for field measurements of radiation vary with the type and intensity of the radiation. In general, the greater the intensity, the better the accuracy needed:

- Radiation therapy, where large doses are required for killing cancerous cells, requires a dose measurement accuracy of about 3 percent. Diagnostic x-rays, on the other hand, require measurement accuracies of 10 percent because the dose is smaller.
- Occupational safety measurements for ionizing radiations frequently require accuracies of about 20 percent for area surveys and about 30 percent for personnel dosimeters.
- Accuracy requirements for environmental field measurements are typically in the range of 10–20 percent, relaxing to a factor-of-two for very low level measurements, such as normal background radioactivity in natural materials.

There are several areas where improvements in measurement capabilities are needed to meet the requirements set forth by regulations or good practice. Accuracy requirements become more rigorous as one moves through the various levels of the measurement support system, starting with field measurements, then to the intermediate level calibrations, and finally the national primary standards maintained by NBS. Adequate accuracy at the higher levels is a prerequisite for satisfying accuracy needs at the lower levels.

In medical applications, three areas of need stand out:

- The accuracy of cobalt-60 radiation therapy dosimetry (that is, measuring radiation exposure or the "absorbed dose") is nearly satisfactory at all levels, but the accuracy of radiation therapy dosimetry for high energy x-rays and electrons is not satisfactory either at NBS or at intermediate level laboratories.
- The accuracy of neutron dosimetry, a new method for radiation therapy, is also unsatisfactory.
- Accuracy available at hospitals and clinics for

medical diagnostic x-rays has not been documented, although capabilities at the Federal intermediate laboratory level and NBS are adequate.

In occupational radiation protection, there is no generally available mechanism for demonstrating the accuracy of field measurements, such as area surveys and monitoring. In personnel monitoring, required accuracies are not available at the field level, the intermediate level, nor in some cases at NBS.

Environmental radioactivity measurement accuracies vary widely. Intermediate level services in the form of radioactivity standards are available from the U.S. Environmental Protection Agency (EPA), but these standards do not provide complete coverage of the field. NBS standards and calibration accuracies for environmental radioactivity appear to be generally satisfactory, and standard reference materials enable the user to calibrate instruments or procedures in terms of the national standards.

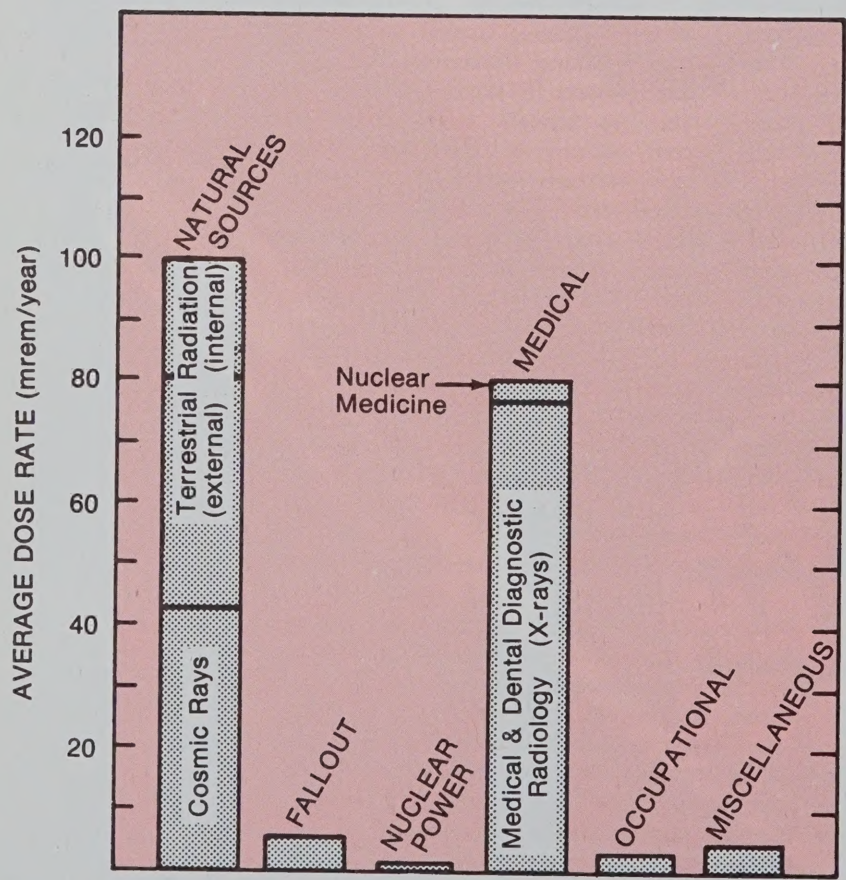


Figure 1—*Estimated average annual whole-body dose rates in the U.S. (1970). (BEIR-1 1972, National Academy of Sciences-National Research Council).*

Measurement Support System

To ensure consistent and accurate measurements at the user level, many technical elements of the measurement support system are necessary. These include measurement standards, calibrations, field instrumentation, data analysis and recording, measurement quality assurance (MQA), documented procedures, research and development, and education and training. To ensure that the system works properly, each element must receive proper attention and must function adequately.

In addition to the technical elements, there are necessary institutional elements of the measurement support system: international standards laboratories, national standards laboratories, intermediate level laboratories, field units, voluntary standards organizations, and professional societies. An effective system is dependent upon the achievement of adequate institutional cooperation in conjunction with the necessary technical capabilities.

The current measurement support system has numerous strong points. National measurement standards exist for many radiation quantities. Calibrations are provided by NBS for many instruments used by intermediate standards laboratories and others. The framework is in place to support and to develop voluntary standards needed for good measurement practice. Several Federal regulatory agencies and professional societies have established intermediate standards laboratories.

Nonetheless, a number of important deficiencies exist. National standards need to be developed or improved in the areas of dosimetry for high-energy x-rays and electrons and fast neutrons, the monitoring of occupational exposure to neutrons and beta rays and measurement of low-level radiation in the general environment. Instrument calibrations and measurement quality assurance services are not available to all who need them. Only a few intermediate standards laboratories now in operation can trace their measurements to national standards. There is a pressing need for intermediate standards laboratories to provide services to State and local regulatory agencies. Instruments available for use at the field level are sometimes inadequate, particularly for measurement of beta and neutron radiation. Other deficiencies include the lack of adequate education and training and an obvious lack of coordination of measurement-related efforts among the various Federal, State, and local regulatory agencies.

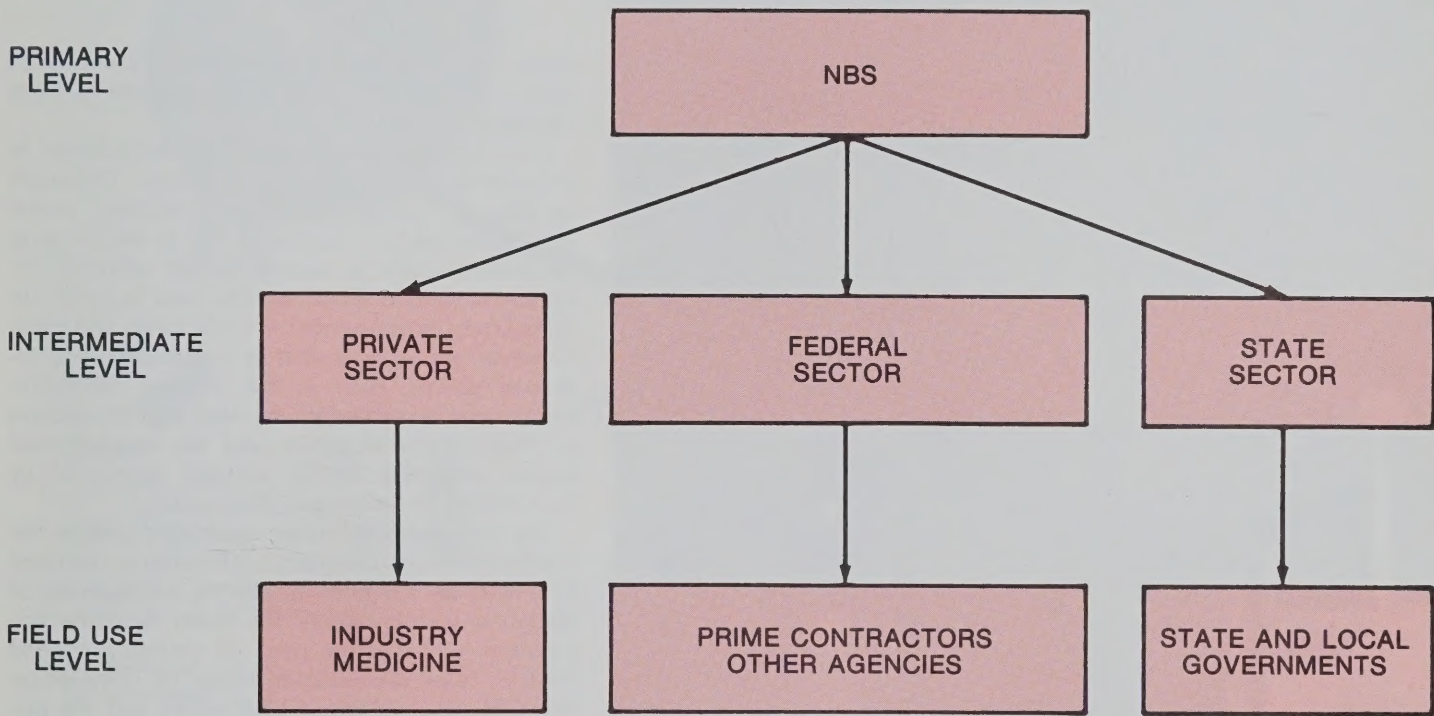


Figure 2—*National measurement support system three-level concept.*

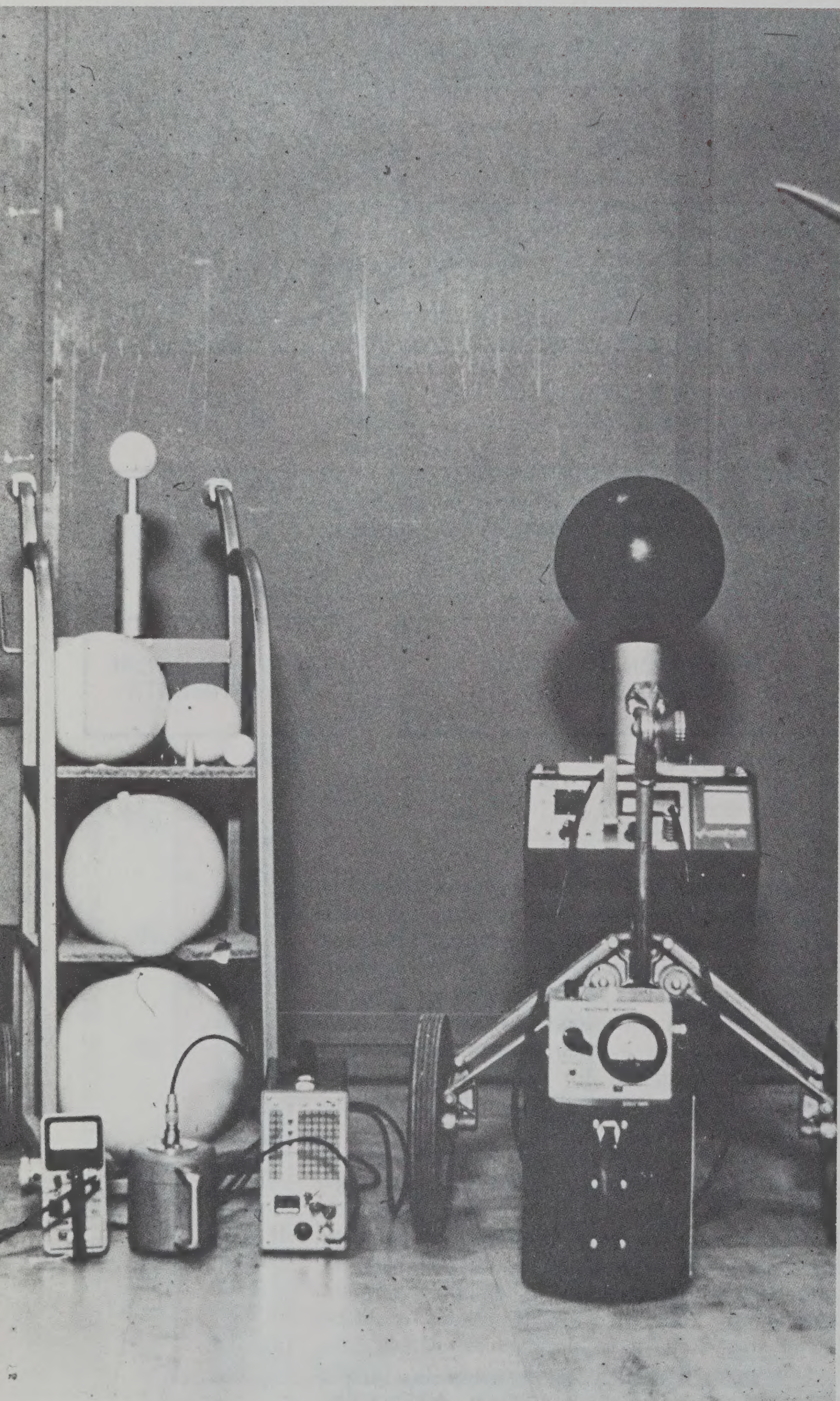
Options For Institutional Improvements

Several ways of restructuring institutional relationships to improve measurement traceability can be considered. One option is a greatly expanded role for NBS in providing direct calibration services to the user. While this would provide direct traceability, the disadvantage of physical distance from the user could cause serious time delay and transportation problems. Also, NBS would be unable to handle the increased volume of services without a significant change in both its resources and the nature of its programs.

Another option would be to use existing radiation laboratories at the Department of Energy (DOE) and Department of Defense (DOD). These labs are well equipped and regionally distributed. However, neither agency has as its mission the provision of measurement and calibration service on a general basis, nor is there traceability to a common set of national standards in all areas.

The Federal regulatory agencies currently provide some calibration and measurement quality assurance services to users. These services might be expanded to give more complete coverage of the radiation measurement field. Again, the regulatory agencies do not have the provision for measurement and calibration services as their general mission, and calibrating instruments for concerns under their jurisdiction may present enforcement problems to the regulator.

Congress might support the establishment of federally funded regional calibration facilities, operated by either the Government or a contractor. This would solve many of the problems described above as these laboratories would be chartered with the specific mission of providing measurement services. The Federal cost of this option would be higher than other possible choices. Duplication and competition with some currently existing private sector services are potential problems. Additionally, federally supported laboratories create a depen-



Several neutron survey instruments. Use of spherical moderators of various sizes gives rough neutron energy spectrum information.

dence of the States on the Federal Government; what is needed is a general improvement of State capability.

Fostering increased private sector involvement in measurement services is another option. This might be done by having contractor-run facilities evolve into "quasi-public" corporations, or by encouraging the private sector to expand current services. Examples of private sector services now in place are calibrations by instrument manufacturers and measurement services provided by professional and industrial groups, such as the regional calibration laboratories accredited by the American Association of Physicists in Medicine and the measurement quality assurance (MQA) program sponsored by the College of American Pathologists.

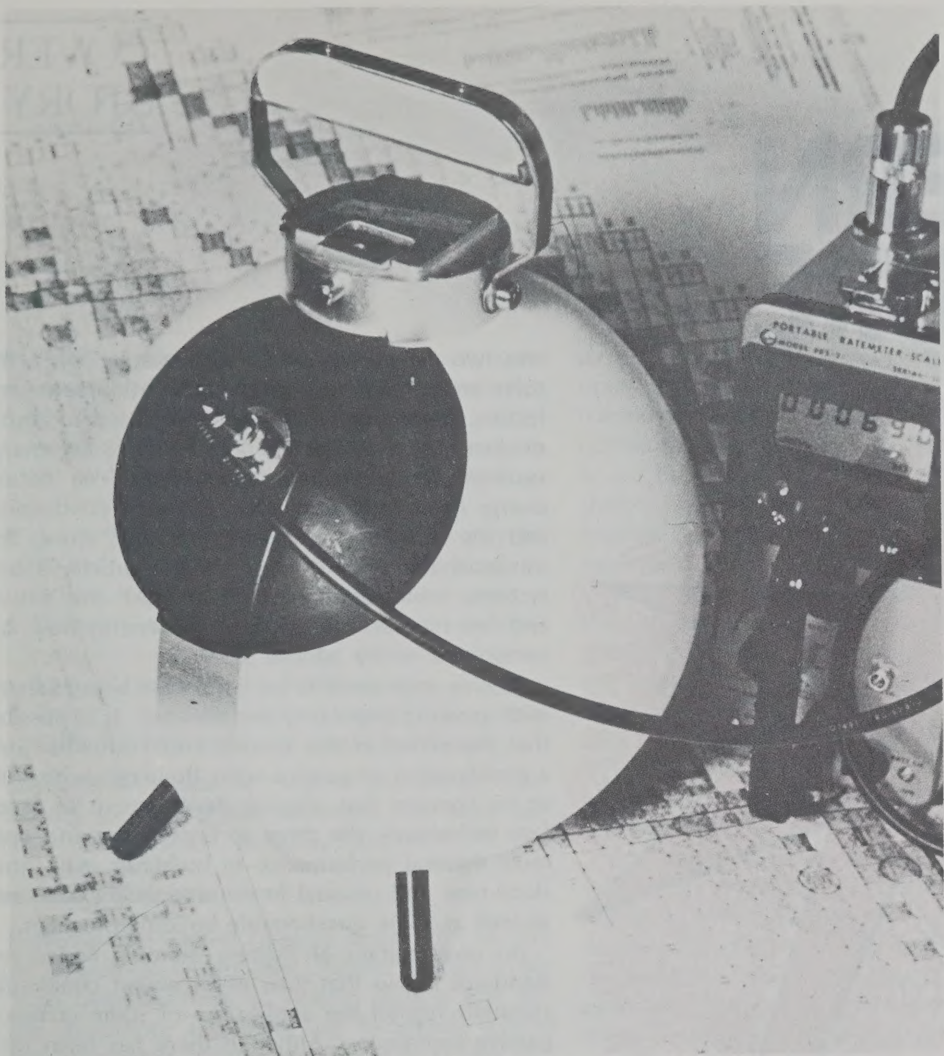
The last possibility to be considered here is the establishment of calibration laboratories operated by a State for a region. By sharing the expenses of operating such a facility, the States have the opportunity to lower the costs of obtaining needed services. One disadvantage might be competition between state-subsidized laboratories and the private sector, which might restrict the users of the facilities to State and local governments. The primary laboratory services would be calibrations, measurement quality assurance, and education and training. To explore this option, NBS has assisted the State of Illinois in the establishment of a pilot regional calibration laboratory.

Program Analysis

Analysts at NBS and the CRCPD believe that the following programmatic and institutional considerations would improve the measurement support system.

Programmatic items to be considered for medical, occupational, and environmental radiation measurement:

- For personnel monitoring, the greatest need is for measurement quality assurance at the field level.
- Occupational radiation survey measurements could benefit from development of a wider range of primary standards, criteria for interactions between the intermediate level and NBS, and development of continuing MQA programs.



Portable neutron survey instrument using spherical moderator.

- For radiation therapy, primary standards should be developed for high-energy x-rays and electrons, and for neutrons.
- Environmental radioactivity measurements could benefit from better-defined traceability for radioactivity standards and cross-check samples issued by intermediate laboratories.
- For very low levels of radiation, national reference standards should be developed and suitable calibrations provided.
- With regard to medical diagnosis, it would be desirable to have operational MQA links between NBS and intermediate laboratories, followed by similar programs between the latter and those making measurements in the field.

Institutional actions needed for improvement of the measurement support system include the provision of more services at the intermediate level; specifically:

- Traceability mechanisms from Federal agencies to NBS could be improved through better interagency communications and cooperation.
- Improving traceability to the private sector is complicated by the diversity of elements involved, such as instrument manufacturers, radiologists, and private calibration services. All levels of the measurement support system, cooperating with the voluntary standards writing organizations, should develop measurement traceability criteria for calibration services provided by the private sector. Further development of calibration services and, particularly, measurement quality assurance programs are needed before the private-sector measurements can be considered satisfactory.
- In the State sector, the Federal Government, in cooperation with the Conference of Radiation Control Program Directors, should foster the establishment of up to seven state-operated regional laboratories to provide calibrations and measurement traceability to State and local radiation control programs. The number of these laboratories and the speed at which they could be established would depend on the amount of funding available.

Recommendations

The most effective measurement support system would provide mechanisms required to ensure the continuing adequacy of radiation measurements that provide for public safety and health. Some of the mechanisms are in place and functioning, but many have not yet been developed. These weaknesses could be overcome with additional technical programs and institutional improvements at the intermediate laboratory level. □

COVER STORY

SOUTHERN EXPOSURE

by Gene Metz

EVER since the time of the Greeks, people have been trying to harness the sun. Today's increasing energy costs and concern about dwindling energy supplies have sparked renewed interest in capturing the sun's energy to heat and cool our houses, offices, and factories.

The solar energy systems being developed fall into two categories—active and passive. In active solar energy systems, mechanical equipment (collectors, pumps, or fans) is generally used to absorb or distribute the solar energy. Passive solar energy systems, on the other hand, depend on natural energy flows (radiation, convection, or conduction) and the buildings themselves to trap, store, and transport the solar energy. In this article, hybrid systems, which make use of at least one natural and one mechanical technique for energy flow, are considered to be passive systems.

Passive solar systems for homes are being greeted with growing popularity and success. It is possible that the extent of this success could snowball into a proliferation of passive solar buildings with little or no concern that, despite development of excellent techniques, the drive to experiment and optimize thermal performance in buildings may introduce new and unusual health and safety concerns, as well as some questionable building practices.

An investigation of existing building codes and standards shows that their enforcement could substantially restrict the application of some common passive techniques. Although there has been little regulatory resistance to passive solar systems in buildings up to now, future use of such systems on a larger scale in many different types of buildings is likely to face more stringent code compliance. While the regulation of passive solar construction should be no more and no less rigorous than for conventional construction, building codes may require some interpretation or even modification for the most effective regulation of passive solar techniques.

Passive solar buildings are distinguished by some unique features that may include the following:

- Interior planning is frequently "open," horizontally as well as vertically.
- Moderate to large expanses of south-facing wall and/or roof surfaces are glazed with glass or plastic materials.
- Openings to the north, east, and west are small or eliminated entirely.
- Walls and attics are heavily insulated and tightly sealed against air infiltration.
- Frequent use is made of high density materials such as masonry for some floors, walls, and partitions to provide mass for energy storage.
- Air is circulated by natural convection or fan-forced through attic, floor, and wall plenums and chases, and through beds of rock under the floor.

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- Various materials such as masonry, water containers, sheet metal, wood, and even insulation boards are often located just behind south-facing glazing to provide surfaces for converting and/or absorbing solar radiation (such as in Trombe walls).
- A variety of massive water containers may be stacked, suspended, or otherwise placed in various locations throughout the structure.
- Frequent use is made of fabrics and insulating materials as shutters, drapes, shades, and other types of movable insulating panels.
- There is increased use of natural light, especially in office and institutional buildings.

Buildings with one or more of the above characteristics (or ones similar to them) may pose significant health as well as safety hazards.

Fire Safety Concerns

Potential fire-related hazards appear to be the most serious safety problem. Passive designs often include large amounts of plastic glazing and exposed insulation, and these are frequently within the air movement streams of the building. Fire and toxic fumes may be propagated via air streams throughout the building, such as by spaces enclosed by the attic (plenums) or walls (chases), and open or "communicating" floors. The problems are compounded in many cases by the lack of adequate ventilation and emergency egress or escape routes due to energy conservation measures such as mounding of earth along one or more sides (earth berming) or reduced numbers and sizes of windows.

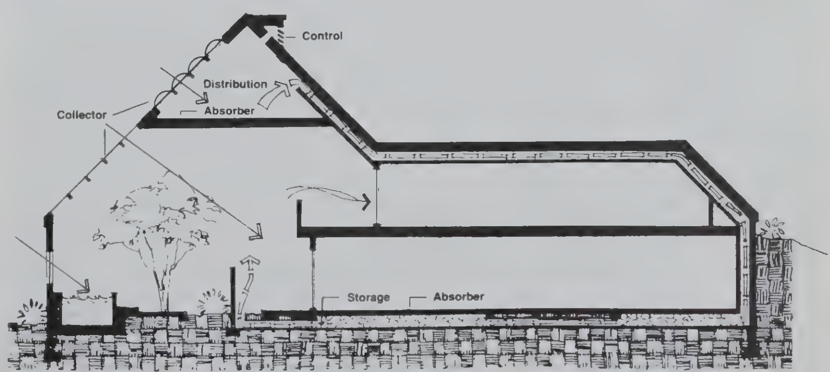
In addition to fire hazards from ignition sources apart from the building/solar components, such as sparks or other fire sources inside or outside the building, the potential for self-ignition due to the generation of elevated temperatures within the passive solar components adds another dimension to the safety problem. When certain passive techniques are used, temperatures can exceed 177 °C (350 °F)* if accumulated thermal energy is not properly removed from the system. Proper care must be taken that materials used are capable of tolerating the temperatures that the system may achieve. High temperature exposure of wood and/or other fibrous materials, as well as other combustible components, may (over an extended period of time) result in the material reaching and surpassing its self-ignition temperature. Such conditions may exist, for example, within collectors framed in wood or inside solar attics. The most commonly accepted ignition temperature of wood is on the order of 200 °C (392 °F). However, studies have indicated that wood may ignite when exposed to a temperature of 100 °C (212 °F) for prolonged periods of time.** The ignition temperatures of plastic and the melt point of insulation may vary above and below those of wood, so the possibility of fire hazard depends on the selection and use of the materials. A metal absorber plate in a thermosiphon collector or in a vented Trombe wall, where wood or plastic insulation is in contact with the back of the plate, is analogous in design to an active collector that was involved recently in a fire.***

It is also important to note that insulation materials may degrade at elevated temperatures and thereby lose their ability to protect adjacent combustible materials from the high temperature. The normal operation of heat removal from solar energy absorbing devices, or the summertime venting of these devices, cannot always be relied upon. This period, when the building heat energy in the col-

Kohler, J., Temple, P., "The Fundamentals of Sitebuilt Collector Design," Solar Age, July 1980.

***National Fire Protection Assoc. Handbook, 14th Edition, 1976.*

****Malmsburg, T., "Solar Collector Fire Sparks Interest," Boulder Daily Camera, July 31, 1980.*



Interior of solar g reenhouse.

lection components is not adequately dissipated ("stagnation"), can be critical and present a hazardous situation. It may occur during shutdown, equipment malfunction, or inadvertent failure to operate vents, dampers, or exhaust fans.

Just as combustible materials in the form of furnishings, draperies, flooring, fabrics, and some building materials in nonsolar buildings frequently diminish fire safety, so will plastic glazings, exposed insulating materials, or wood-framed collector components, if used, add to the fire hazard. Fire safety will increase in significance as passive technologies are extended to building types other than single family residential.

Protective alternatives are needed to neutralize the fire hazard impact of some passive techniques. Sprinkler systems are somewhat expensive but are considered effective for most construction types and occupancies. Fire resistive coatings are available for many exposed combustible materials. Glass, especially safety glass, is generally preferable to plastic glazing in considering fire safety. If plastic glazings are used, thermosetting plastic may have the advantage over other types by not producing burning materials that could fall into interior spaces as thermoplastic materials sometimes do.

Air circulation through voids within the building envelope is generally in conflict with building codes and the principle of restricting the spread of fire and smoke. Therefore, non-combustible materials should be considered for air chase and plenum construction. Smoke activated fire dampers may also help prevent fire and fumes from spreading and alleviate the requirements for firestops.

Building codes require at least one operable window or exterior door for emergency egress or rescue from all sleeping rooms. It is common in passive solar designs for exterior openings to be greatly reduced on all but the south-facing side to reduce heat loss. Earth contact buildings frequently mean complete elimination of exterior openings for some rooms. The judicious use of interconnected smoke detectors and access to corridors that have convenient exits should be considered if the requirements for emergency exits from individual rooms are not met.

Physical Hazards

Glass breakage constitutes one of the most commonly acknowledged physical hazards in residential design. Each year in the United States there are approximately 215,000 injuries associated with glass

breakage in residential windows.* Passive designs frequently add substantially to the amount of glass used, often in uncommon applications. This increases the concern for safety, especially for residential installations where occupant activities are quite varied. The use of tempered glass is an excellent precaution and should not significantly increase cost if standard sizes are used. Guard rails or other "barriers," to prevent people from falling into glass panels or children from climbing on them, should be considered.

Current code restrictions address the use of glass in and adjacent to entrance doors. Safety glazing is permitted and code restrictions should not have significant additional effect on passive techniques. Another code restriction (relating to the spread of fire from story to story) is placed on the use of windows and requires a 3-foot** separation for openings that are located vertically, one above the other, in most types of construction. Without this separation, window areas cannot exceed 30 to 40 percent of the wall area. Horizontal projections or overhangs of at least 3 feet** are an acceptable alternative and should serve passive technology well by also providing shade during the summer months.

Glass skylights and clerestory windows offer another hazard considering that they can fall into occupied spaces when broken by wind or flying objects. Other safety concerns in connection with skylights, and the primary reason for building code restrictions of them, are related to fire safety and access for fire-fighting. Some codes require that skylights in roofs support the minimum live loads required for other roofing materials and that they be of materials that do not fragment. Generally, they may not exceed 100 square feet, must be at least 5 feet apart, and their total area cannot exceed 20 percent or the floor area of the room below. Plastic skylights may be required to be sloped, shaped, or covered with screening so that flying fire brands cannot lodge on them. Skylights over exits or air shafts are required by some codes to be of non-combustible materials that can be easily pierced by fire-fighters. Screens, above or below, may also be required.

Other physical hazards involve massive storage elements, including water containers occasionally placed in precarious positions. Water containers

*Home Safety Guidelines for Architects and Builders, NBS-GCR 78-156, Dec. 1978.

**Exact values as given in the codes (metric equivalent is about 0.9 m).

Two-story Trombe wall.

are often stacked or used vertically, making them vulnerable to overturning on impact or shifting of base support. The level of this hazard increases if they are in the immediate vicinity of room occupants or near glass panels and are filled with water that may be at elevated temperatures.

The issue of failure of support raises another question somewhat unique to solar technology. Prolonged exposure of wood to elevated temperatures on the order of 100 °C (212 °F) or more not only reduces the fire resistance of the wood but also significantly reduces the structural capacity of the wooden members. The desiccation of wood can result in a 50 percent loss of compressive strength* and the failure of wood structural members supporting massive storage elements may have serious consequences.

Air Quality

The probabilities of a buildup of indoor air pollutants due to characteristics of passive solar buildings have not been determined precisely and the level of hazard they present is uncertain. Polluting sources may include: radon, asbestos, or pesticides in the soil, rock beds, and masonry construction materials; bacteria and fungus, primarily in rock beds; and decomposition products resulting from elevated temperatures in some insulation and sealant materials. The characteristic of tightly fitted buildings with minimum air infiltration will intensify the effects of whatever air contaminants exist internally.

Current trends in energy efficient construction similar to passive techniques can produce a tenfold increase in the interim level of radon and related radioactive gas activity.** The probability of occurrence of bacteria, fungus, and mildew in rock storage areas is increased when the storage is used for both cooling and heating, because of condensation of moisture.

Because the same air stream is circulated into occupied spaces, and the location of the contamination is often inaccessible for monitoring or correcting, building materials should be carefully selected. Rocks for rock storage areas should be washed, and where feasible, access to the storage area should be provided for visual inspection. Filtering of the air stream, while desirable, is often impractical because of low air flows common in passive systems.

*Ingberg, S. H., "Compression Tests of Wood at Elevated Temperatures," ASTM Reprint, Vol. 59, 1959.

**McNall, P., Silberstein, S., "Radon in Buildings," NBS Spec. Publ. 581, June 1980.

Ventilation Factors

Code requirements relating to air quality are very general except as they pertain to ventilation. Some passive designs function more efficiently when temperatures are allowed to fluctuate widely for large portions of habitable space. Such temperature changes can be tolerable and even appropriate for average adults under normal circumstances and life styles, but for small infants and the elderly or infirm there could be serious health concerns.

Typically, codes require that the capability be provided to maintain a temperature of 20 to 21 °C (68 to 70 °F) in habitable rooms of multi-family buildings. Investigative work is needed to determine the role that automatic controls should play in maintaining the required temperature, how freeze protection should be specified for times when occupants are away (if it is not automatic), and what temperature should be expected in passive solar buildings that are not occupied at night.

Natural ventilation through the use of unobstructed ventilation openings equal to 4 or 5 percent of the room floor area is a typical code requirement. Such ventilation must be directly to the outside through devices in the exterior walls or the roof. Where mechanical ventilation is provided, unobstructed openings are not required. For habitable rooms, mechanical ventilation must be capable of providing two changes of air per hour, but 75 percent of this can be recirculated (100 percent for single dwelling units), if the air is not returned through common hallways, stairways, or other family units.

These restrictions may prevent the use of south-facing corridors as a direct gain technique (solar heating of space shared by several units). Thermal circulation techniques involving common stairways and corridors are not likely to be permitted by code, nor is natural ventilation into individual units through exterior enclosed corridors.

Other Considerations

Although there has been little evidence of actual occurrences, there have been frequent precautions about the adverse effects of increased humidity, insects, insecticides, and odors resulting from solar greenhouses. Many early passive solar buildings lacked the means to control some of the above adverse conditions. However, many recent solar buildings are proving to be not only healthy but comfortable. The most important reason for this is probably the effect of the thermal radiant environment on comfort.*

The provision of natural illumination is another opportunity for passive solar design. Codes for

some buildings do not significantly constrain passive solutions except for the limitations of size and ratio of window area to wall area. For many office, institution, and other multi-occupancy types, the provision of natural light is the most important contribution of passive solar design. Energy demands for lighting are more significant than for heating and cooling in many office buildings for some climatic zones. However, glare is one problem that can result from a poor design attempt to provide adequate levels of illumination through passive techniques.

Noise is another possible disturbing factor in buildings that are open in plan and space. Also, the prevalence of dense surfaces (such as masonry) in passive designs may amplify noises that originate inside the building. The presence of a large proportion of openings, such as the south-facing windows of a passive building, may not provide adequate resistance to noise that originates outside the building.

Most code provisions relate to sound transmission from public access spaces and between adjacent dwelling units. Some may apply to passive windows walls, especially in congested environments. The National Building Code requires that sound transmission through exterior walls of residential buildings must not exceed 45 dB (at low and high frequencies) for more than 30 minutes between 11:00 p.m. and 7:00 a.m. Most single-glazed assemblies will not meet this requirement in moderately noisy areas. Two or more glazings might be adequate, and the use of nighttime insulation, such as special shutters, drapes, or shades, should be helpful in meeting this code provision.

Conclusions

A preliminary examination of building codes has shown that they pose significant constraints on the application of some passive solar techniques. Most of these seem to be completely justified, while others require efforts of interpretation, research, and testing of passive assemblies to determine levels of safety. Some provisions that seem overly restrictive, such as on the extent of earth berming, the percentage of allowable window and skylight areas, and requirements for natural light and ventilation, should be considered on a case-by-case basis. Some codes might reasonably be modified and approval of safe alternatives expedited. Most often their intent can be achieved and safety hazards can be avoided with little sacrifice in economy or performance. □

Balcomb, D., et al., "Passive Solar Design Handbook," Vol. 2: Passive Solar Design Analysis, prepared for DOE by Los Alamos Scientific Lab., Jan. 1980.

Solar greenhouse.

Exterior of solar greenhouse.

PASSIVE SOLAR RETROFITS

Gene Metz, author of the accompanying article, practices what he preaches. He accepted the challenge of using passive applications of solar energy for existing buildings in two completed projects of historic restoration and for one in progress.

Solar Greenhouse: In August 1979 he completed a 2-story solar greenhouse attached to his home. It is approximately 24 feet high, with 175 square feet at the ground level and a small balcony at the second level. About 400 square feet of south-facing glazing has equal portions of insulating glass and double skinned acrylic panels. There are 2 sliding glass doors at the first level, 2 sliding windows at the second level, and a sloping roof vent. Two windows and a door occur in the existing wall at each of the 2 levels. Thermal energy storage is provided in the existing 10-inch brick wall, a new brick-on-slab floor, and approximately 350 gallons of water in small steel drums and glass fiber water tubes. Movable insulation was added during midwinter. Deciduous vines are used as a shading device for the length of the south facade. Heat distribution is accomplished by natural convection loops and is aided by an existing stairway connecting the first and second levels of the house approximately 25 feet inside from the greenhouse.

The existing balcony and other architectural features remain undisturbed by the solar greenhouse. The glazed facade wraps around these, complementing them in scale, proportion, and color. The existing features are effective in providing storage mass and control by way of summer shading, energy distribution, and ventilation. The greenhouse accounted for an estimated 40 percent reduction in fuel oil use during the 1979-1980 heating season. The potential for overheating was resolved during the warmest period of the fall of 1979 and summer of 1980 by means of partial shading and full ventilation. The space has provided a healthy growing environment for a variety of plants and has extended the living space of the house.

Trombe Wall Retrofit: A 2-story Trombe wall is part of the renovation of a small two-apartment complex completed in February 1980. The retrofit consists of approximately 135 square feet of wall area on 2 levels. The lower level is of brick construction and the upper

Retrofit in progress.

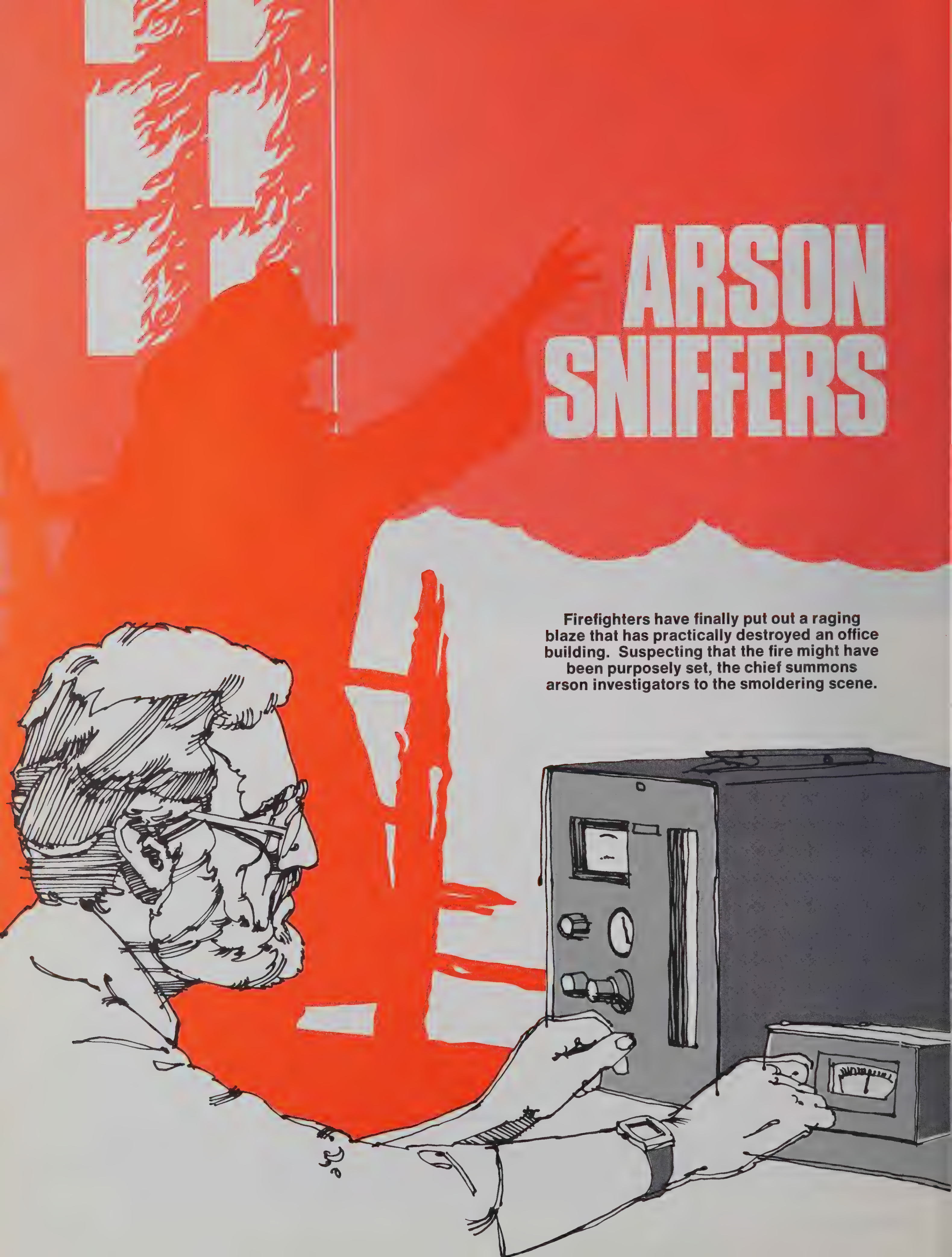
level is sheet metal on frame construction. Both walls are vented to the interior, but vent sizes and placements were compromised by interior arrangements. The glazing is ⅝ inch insulating glass in a wood frame. The air space has operable exterior vents at both levels. Although no performance data are available, the effectiveness of the system seems significant for partial space heating. During the summer months the exterior vents are opened and the top vents to the interior are closed off with insulated panels. There is some evidence that the Trombe wall is effective in creating a "stack effect" and inducing ventilation through the house.

Retrofit in Progress: A third project has been given a positive appraisal by the Historic District Commission. It represents a more significant historic consideration because the passive solar sunspaces are prominently open to public view on two levels separated by a concrete and tile floor. The existing house has 3 stories, with a two-story wing, solid brick walls (except one side with cement stucco facing), and a large, windowed bay 2 stories high. The south-facing sunspace addition is six-sided and projects similarly to the existing three-sided bay. The east and west walls of the sunspace are solid brick and are perpendicular to the existing brick wall of the house, which becomes the back or north side of the passive addition.

The south-facing "facets" are glazed with a sliding door (or window) in the middle bay. The two-angled sides help to facilitate the otherwise constrained circulation of the three different apartments to the side and rear yards. The east and west brick walls are heavily insulated *on the outside* and stuccoed. This provides additional storage mass in the interior of the sunspace. The stucco finish creates a visual contrast to the adjacent brick walls of the existing house but complements the stucco finish of a nearby wing. Glazed doors and transoms connect the sunspaces to the house interiors and serve as control devices for warm air circulation. Overhangs and a louvered trellis above the first level provide for sunshading in summer.

Experience with these units during this heating season will determine if additional heat energy storage in the form of water containers or movable insulation is required to improve the thermal efficiency of the spaces.

ARSON SNIFFERS



Firefighters have finally put out a raging blaze that has practically destroyed an office building. Suspecting that the fire might have been purposely set, the chief summons arson investigators to the smoldering scene.

by Emily Rudin

THE investigators might bring with them a portable vapor detector, or "sniffer," a key tool in determining the fire's cause. After the fire has been extinguished, this device is used to sample the air for flammable hydrocarbon vapors which evolve from residual petroleum distillates. These include gasoline, kerosene, and paint thinner, the most common "accelerants" used by arsonists to set fires.

Samples of nearby debris likely to contain accelerants are then located, collected, and sent to a forensic laboratory for chemical analysis and identification of the accelerant. Chances of finding evidence of arson depend on the time elapsed since the fire, the solubility of the accelerant used, the porosity of materials in which the accelerant is absorbed, and the detector's sensitivity.

In the past there has been no reliable, readily available method to determine the sensitivity or to maintain the adequacy of arson detectors. In fact, in a typical situation, there is a good chance that the device is not accurate. It might not have been used for some time, it might have been contaminated, or perhaps it was never sensitive enough to begin with. A poorly functioning sniffer may mean the difference between a sound investigation with definite results and a time-wasting exercise that permits an arsonist to get away and set more fires.

Now, however, there is a way to make the detector more reliable. Researchers at the NBS Center for Fire Research (CFR) have developed a combustible vapor generator intended to improve calibration of sniffers and thus to help combat the growing problem of arson in the United States. Last year, property losses attributable to arson were estimated at $1.3 billion, a substantial increase over prior years.

According to Merritt Birky, head of CFR's Combustion Toxicology Research Group, "The new vapor generator will help police, fire officials, and forensic laboratory technicians evaluate the sensitivity of their detectors to vapors of hydrocarbons."

The project was requested and supported by the Department of Justice's Law Enforcement Assistance Administration and coordinated by the NBS Law Enforcement Standards Laboratory. NBS is submitting a report on the device to LEAA, recommending it for use as a technical aid for arson investigators.

Researchers at the Center developed the device by adapting technology used in air pollution monitors. The Bureau's instrument generates a standard sample of hydrocarbon vapor that is used to test the detector's sensitivity. To produce this sample, the researchers selected four compounds that represent two of the major classes of organic compounds found in gasoline, a readily available accelerant. Aliphatic hydrocarbons are represented by both linear and branch compounds, aromatic hydrocarbons by toluene and xylene. "These compounds should cover the basic accelerants arsonists most frequently use," says research chemist James E. Brown, the project's principal investigator.

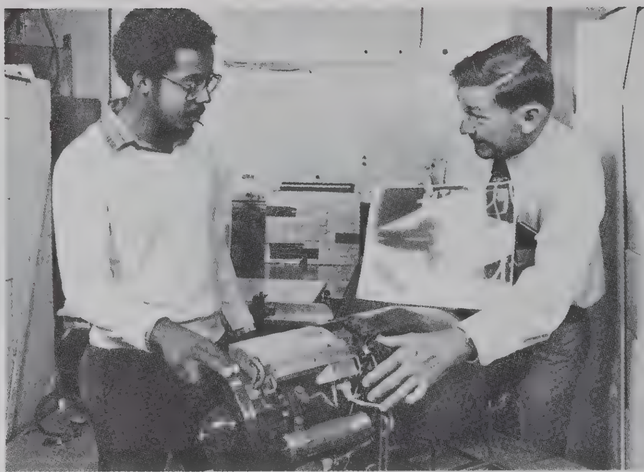
The amount of combustible gas released by this generator is important; it allows the user to assess a detector's specific sensitivity to very low, medium, and high levels of hydrocarbon vapor. According to Brown, there are two ways to control this amount with the NBS device. "Either we can vary the temperature at which the hydrocarbon sample is maintained in its liquid state, which determines its vapor pressure," he explains, "or we can vary the diameter and length of the tube through which the vapor must diffuse. The longer and thinner the tube, the smaller the amount of vapor generated."

As part of a followup effort, NBS researchers are evaluating key aspects of several different commercial vapor detectors: range of sensitivity, response time, and ability to give accurate and consistent readings. Bureau scientists will then investigate standard levels of hydrocarbon vapor that detectors can be expected to find in different types of material. Information produced by this research should help fire investigators and laboratories to understand the performance and limitations of commercial sniffers, make the devices' results more reliable, and aid in the Bureau's development of a performance standard for sniffers. □

Rudin is a writer and public information specialist in the NBS Public Information Division.

NEUTRON RADIOGRAPHY USED FOR INSPECTING JET ENGINES

by Gail Porter



NBS physicist Donald Garrett (right) and engineering technician Michael Dorsey discuss their recent success in using neutron radiography to visualize oil levels within a small gas turbine engine.

A researcher at the National Bureau of Standards has demonstrated that jet engines may be inspected nondestructively with neutron radiography, a method of using neutrons to visualize details of internal structures. In a cooperative program with the U.S. Navy and Teledyne CAE (a manufacturer of small gas turbine engines), NBS physicist Donald Garrett has used neutron radiography to check quickly for safe oil levels within compact jet engines used in missile systems.

The Bureau's success in imaging internal lubricant levels much more clearly than was previously possible with x-ray techniques illustrates the usefulness of neutron radiography as a promising new research tool for engine designers.

The Navy and Teledyne asked for NBS assistance while in search of a more efficient method to verify lubricating oil levels for a special jet engine 74 cm (29 inches) long. Manual sighting of the oil level requires a tedious partial disassembly of the engine and takes about an hour to complete.

Preliminary testing with x-rays had produced poor contrast of the internal components, due to the inadequate penetration of the x-rays through the many layers of heavy metal within the engine. In addition, x-rays generally provide poor images of low atomic weight elements such as hydrogen, which (with carbon) is the major element in lubricating oil.

However, using thermal (slowed down) neutrons from the NBS high-flux research reactor, Garrett succeeded in imaging the exact level of oil within the central-most cavity of a sample engine in as little as ten minutes.

Garrett's laboratory at NBS is one of a few in the world actively involved in producing high resolution neutron radiographs and in developing improved neutron radiography techniques. In the past he has used neutrons to take "pictures" of a wide variety of objects that could not be inspected adequately with x-rays, for one reason or another.

Some of these past projects have included scanning the interior of an ancient Chinese urn made from lead, testing for quality control in the production of high-performance zirconium alloy turbine blades, pinpointing trouble spots in the production of tiny explosive devices used in activating solar panels on spacecraft, and studying the detailed chemical kinetics in certain types of pacemaker batteries as they are run down.

The beam of neutrons required by neutron radiography is produced at NBS by a research reactor. In this most recent work for the Navy and Teledyne CAE, Garrett aims a beam of neutrons approximately 30 cm wide directly at a sample engine. Elements within the engine that have high neutron cross-sections will tend to either capture or deflect neutrons from the incoming beam. Elements with low neutron cross-sections will allow the neutrons to pass through the engine to a very thin sheet of gadolinium metal, which is in close contact with a film of photographic emulsion.

Gadolinium absorbs a higher number of neutrons than any other element. Each time a neutron passes through the engine it is captured by the nucleus of a gadolinium atom and an electron from that atom is ejected into the emulsion, thus producing an image. According to Teledyne CAE project leader Robert Anderson, the radiographs of the engine produced with neutrons are "far superior" to those that have been produced with x-rays. However, Teledyne will continue to use x-ray inspection to verify the oil levels of their engines, due to recent improvements in resolution gained with x-ray techniques and because the company needs a portable device that can be used at field sites and operated at low cost.

The most promising application of neutron radiography for engine manufacturers lies elsewhere. The real value of neutron radiography in this field, says Anderson, may be for research applications in the design of new engines and the inspection of clearance between parts.

Garrett says he believes it may also be possible to adapt his neutron radiography apparatus so as to view the lubrication or fuel cycles of operating engines in real-time on a television screen. Theoretically, says Garrett, these kinds of moving pictures of critical engine functions should be possible and might prove an invaluable tool for improving engine designs of all types. As a first step toward this goal, Garrett is now trying to develop a high speed neutron radiography imaging screen.

Porter is a writer and public information specialist in the NBS Public Information Division.

"TRACEALLOY" STANDARD ISSUED

The preparation of these standard reference materials (SRM's 897, 898, and 899) began in the mid-1970's when the Subcommittee on Trace Elements in Superalloys of the Gas Turbine Panel, ASTM-ASME-MPC Joint Committee,* initiated a program to confirm the feasibility of superalloy trace element standards. Earlier, 5 trace elements were selected by the industry as being the most detrimental to the performance of nickel-base superalloys: bismuth, lead, selenium, tellurium, and thallium. Also, the nominal composition of the nickel-base alloy had been adopted to contain all of the elements found in turbine blade applications and was designated "Tracealloy."

Three heats, about 135 kg each, of the "tracealloy" compositions were melted by vacuum induction, portions of trace element master alloy were added under partial pressure, and a series of ingots, 7.6 cm in diameter and 76 cm long, were statically cast. Samples were submitted to more than 25 laboratories for analysis. Data were collected and evaluated to establish the validity of trace element standards for nickel-base superalloys. Homogeneity studies showed no detectable segregation of the trace elements from top to bottom of the ingots.

At a meeting of the Joint Committee and NBS, the decision was made to turn the remaining materials, about 60 kg of each, over to NBS for processing and analyses leading to certification. At NBS, material was selected from each lot that exhibited minimum piping. Following complete removal of scale and cold shuts from the periphery of the ingot sections, each material was converted into fine millings, sieved, and thoroughly blended to form the SRM's. Table 1 gives the value and uncertainty of each.

Table 2 gives values for bismuth (Bi), based on an evaluation of data obtained by the Trace Element Task Force of the subcommittee originating the tracealloy program. The data were provided by 26 participating laboratories on samples from the case ingots prior to acquisition of the materials by NBS. The values for Bi are in close agreement with the original aim compositions. Because a "definitive" method has not yet been established at NBS and because of lack of agreement among various methods that have been used, Bi values have not been accepted for NBS certification. Although NOT CERTIFIED, use of the average values reported above is recommended.

Chemical analyses for certification were performed in the NBS Inorganic Analytical Research Division by L. P. Dunstan, J. W. Gramlich, H. M. Kingston, L. A. Machlan, E. J. Maienthal, J. D. Messman, P. J. Paulsen and T. C. Rains. The overall coordination of the NBS analytical measurements leading to certification was under the direction of I. L. Barnes and technical and support aspects involved were coordinated through the Office of Standard Reference Materials by R. E. Michaelis. Special acknowledgment is given to the many members of the ASTM-ASME-MPC Joint Committee and to industry for valuable supportive efforts.

* *Joint Committee on the Effect of Temperature on the Properties of Metals, composed of representatives from the American Society for Testing and Materials (ASTM), the American Society of Mechanical Engineers (ASME), and the Metal Properties Council (MPC).*

Table 1. VALUES AND UNCERTAINTIES

SRM No. Designation	897 "Tracealloy" A		898 "Tracealloy" B		899 "Tracealloy" C	
Element	Value[a]	Estimated Uncertainty[a]	Value[a]	Estimated Uncertainty[a]	Value[a]	Estimated Uncertainty[a]
			Parts per Million by Weight (μg/g)			
Lead[b]	14.7	0.8	3.1	0.6	4.9	0.1
Selenium[c]	9.1	0.1	2.00	0.02	9.5	0.1
Tellurium[c]	1.05	0.07	0.54	0.02	5.9	0.6
Thallium[b]	0.51	0.03	2.75	0.02	0.252	0.003

[a] All values listed for each element are the *present best estimate* of the "true" based on the results of the analytical program for certification. The estimated uncertainty listed in each case is based on judgment and represents an evaluation of method imprecision, possible systematic errors, and material variability for samples of 1.0 g or more.
[b] Values for Pb and Tl are based on determinations at NBS by the "definitive" method of isotope dilution mass spectrometry.
[c] Values for Se and Te are based on determinations at NBS by the "definitive" method of isotope dilution spark source mass spectrometry.

Table 2. RECOMMENDED VALUES

SRM No.	897	898	899
Designation	"Tracealloy" A	"Tracealloy" B	"Tracealloy" C
Element		Parts per Million by Weight (μg/g)	
Bismuth	(0.53)	(1.1)	(0.26)

ACTIVITIES IN WOOD-HEATING SAFETY

The U.S. Department of Energy, as part of a program to facilitate the increased use of wood as an alternative energy source, has sponsored studies at the Center for Fire Research (CFR) of the National Bureau of Standards to investigate the fire safety of wood-burning appliances used for space heating in single-family dwellings and similar small-scale applications.

The present research program at CFR includes:

- *a survey of fire incidents involving wood-burning appliances;*
- *a review of codes and standards dealing with solid-fuel appliances;*
- *experimental studies to develop information in the areas of clearance to combustibles, chimney creosoting and chimney fires, fireplace inserts, and products of combustion;*
- *technical input to a public education effort by DOE and other Government agencies.*

Since research is continuing, information is provided only on part of the program.

R. D. Peacock, Fire Performance Evaluation Division, A345 Polymers Building, 301/921-3116.

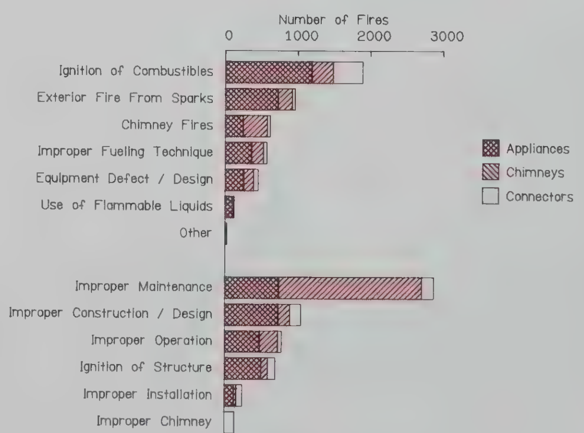
During the first year of this program, research has been directed at an accident survey, a literature review, and a codes and standards analysis that would establish accident patterns, determine types of risks involved with the wood-burning appliances, and ascertain the adequacy of existing codes and standards in terms of those risks. Approximately 12 000 fire incidents covering the period 1975-1978 were analyzed to establish accident patterns and to determine the types of risks. Fire incident data were provided from the following sources: National Fire Incident Reporting System (NFIRS), U.S. Fire Administration; National Electronic Injury Surveillance System; Massachusetts State Fire Marshal's Office; Oregon State Fire Marshal's Office; National Fire Protection Association (NFPA); and Flammable Fabrics Accident Case and Testing System.

Product malfunction, construction defects, design deficiencies, or wornout equipment were stated to be the cause in only 13 percent of the solid-fuel-related fires recorded in the U.S. Fire Administration data base, demonstrating that conditions related to the installation, operation, or maintenance of the appliances were responsible for the fires. From the standpoint of fire safety, the most important areas for concern are:

- the ignition of adjacent combustibles by heat from wood-burning equipment;
- the use of wood-burning equipment with improper, defective, or poorly maintained chimneys and resultant chimney fires; and
- the ignition of building exteriors by sparks escaping from chimneys.

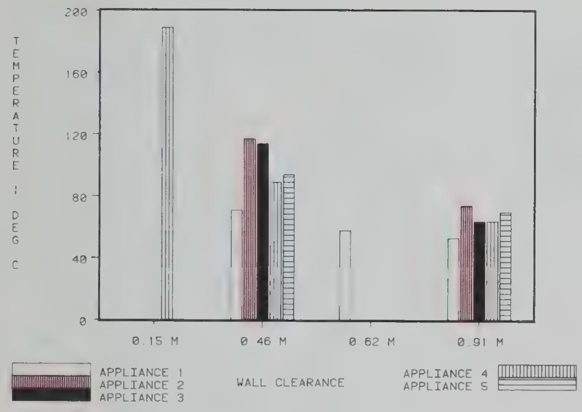
The data used should not be construed to give a true picture of the entire fire incident population for the United States relative to wood heating. The reasons for this are: First, data were available for only 21 States in the NFIRS data base at the time of the study; no information was available for other States or for fires not reported to the fire services in the States studied. Second, data were not available to compare the magnitude of the fire problems associated with wood-burning appliances to other fuels; an assessment of the fires involving other types of heating equipment and the number of each type in use would be required to make the comparison. Finally, to compare and to evaluate the importance of injury and death statistics, the level of exposure to the equipment involved must be estimated. Thus, the information is useful primarily for identifying priorities for future study and emphasis on fire hazards related to wood heating.

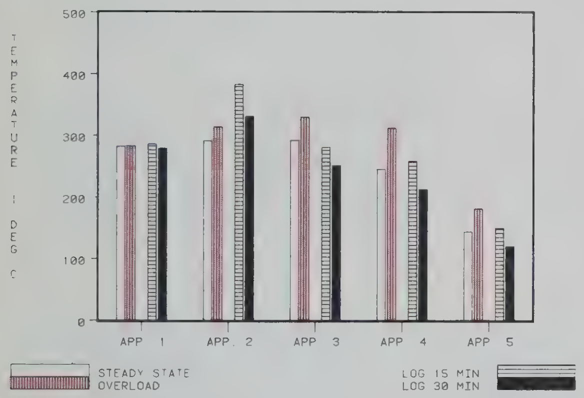
In addition to the data analysis, a series of 28 full-scale tests has been completed using five different wood-burning appliances (3 radiant room heaters, a "Franklin" type fireplace stove, and a circulating or convective type room heater). Tests were conducted in an instrumented enclosure constructed according to standard test practices. A total of more than one-half million individual readings of temperature, heat flux, or velocity were obtained in two series: full-scale room

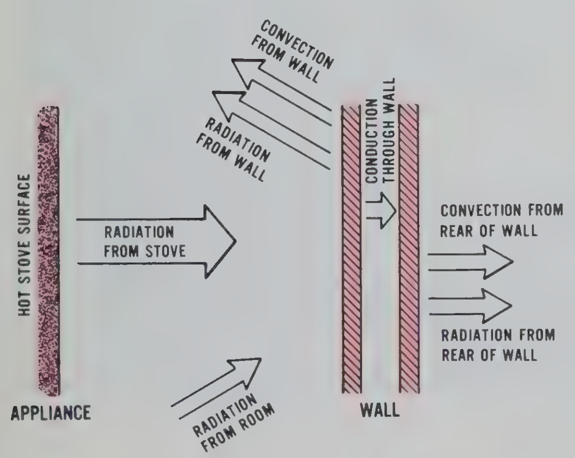


Breakdown of Fire Incidents by Equipment Type as Recorded in NFIRS Solid Fuel Fire Incident Data

SOURCE: USFA NFIRS Data Base







experiments where measurements of appliance temperatures and surrounding surface temperatures were obtained using a standard wood fuel source consisting of a cross-pile of finished lumber, and "log tests" where seasoned oak logs were used as a fuel source to compare with the standard wood fuel source. Only appliance surface temperatures and flue gas temperatures were monitored in these tests.

The following results were noted:

- Appliance firebox surface temperatures measured during steady-state operation were very similar for all five appliances tested. For a jacketed circulating room heater, outside jacket temperatures were lower. Appliance surface temperatures did not change significantly as the clearance between an appliance and the wall was reduced. For some appliances, the temperatures were slightly higher at smaller clearances and slightly lower for others. The probable explanation is that the large mass of the appliance prevented it from being affected by the changing convective airflows or by re-radiation from the hot wall surface.
- Because of its light weight, the single wall flue pipe used for testing was affected by the different airflow patterns and hot wall surface temperatures at different appliance/wall clearances.
- Wall surface temperatures were found to vary inversely with the clearance between the appliance and wall surface. Steady-state wall temperatures as high as 189 °C were recorded (for an improperly installed appliance).
- Appliance design and appliance size were found to affect temperatures on wall surfaces.
- Due to the small clearances between appliances and flooring, temperatures developed on unprotected floor surfaces were typically higher than wall temperatures during the tests.
- Wall surface temperatures and interior wall studying temperatures were considerably higher with than without insulation in the wall and stud space and more restricted ventilation in the test enclosure.

• Average maximum appliance surface temperatures measured during tests using seasoned oak logs as the fuel source were similar to those developed with the standard fuel source.

• A heat transfer model was developed for prediction of wall surface temperature on walls exposed to heating by flue pipe or appliance surfaces. Theoretical calculations of wall surface temperatures agreed with measured wall temperatures within an average value of 10 °C. Agreement of individual calculations, however, ranged from excellent to poor.

Three specific recommendations are made based on the results of these tests:

• Current codes for the installation of appliances are based in part on data developed in 1943 by Underwriters Laboratories (UL). By comparison with UL data, the requirements in the NFPA code were based on appliance surface temperatures ranging from 315 °C (600 °F) for unprotected surfaces to 480 °C (900 °F) and above for various protection methods. The temperature of appliances tested in this study could easily exceed the lower limit of this range for extended periods of time. The new data indicate that a more appropriate lower limit for unprotected surfaces would be 400 °C (750 °F).

• Floor protection is clearly an important area that should be addressed specifically in the codes.

• Because of the higher temperatures developed during tests with wall insulation, it may be appropriate to modify current test procedures to include "typical" insulation of walls of the test enclosure.

Existing criteria for the installation of wood-burning appliances are based on data developed nearly 40 years ago and do not provide information on materials of construction or appliances available in the current market or allow for variations based on the use of new materials. Accordingly, the plan for further experimental research stresses the installation, operation, and maintenance of wood-burning appliances, with some specific objectives for the work during the second and third years of the program. CFR has identified three general tasks:

• Performing necessary experimental and analytical studies to develop and quantify safe, reasonable limits for important fire safety parameters including clearances to combustibles, chimney creosoting and chimney fires, and products of combustion.

• Providing the technical input to a public education program to be developed in conjunction with public education efforts at NBS, DOE, and other Government agencies.

• Interfacing with the appropriate model code agencies and consensus standards groups to encourage the prompt adoption of changes that are desirable for the safe and optimum use of the wood resource.

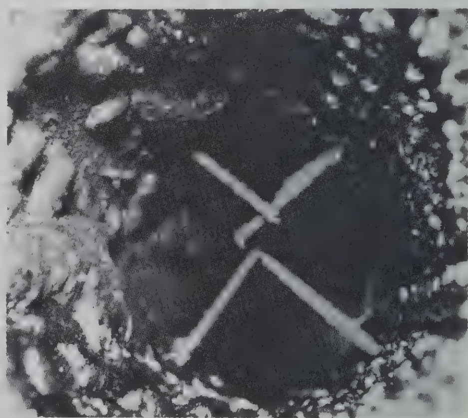
Tests are currently underway to study the installation of wood-burning appliances at reduced clearances with appropriate protection of combustible surfaces. Tests have also started to investigate creosote accumulation and resultant chimney fires in typical installations.

Currently available factory-built chimneys have been installed according to the manufacturers' recommendations and instrumented to measure temperatures on chimney, enclosure, and surrounding surfaces. The chimneys are connected to identical radiant room heaters that are fired at similar fueling rates to study creosote accumulation and the intensity of resultant chimney fires.

A "standard radiant room heater" was designed and constructed at NBS to expose different wall-protective devices to heating levels typically received from adjacent wood-burning appliances. Each of these assemblies is evaluated when installed on a surface of gypsum wallboard, instrumented with thermocouples, and then exposed to the radiant room heater. The relative protection provided by the wall-protective device is determined.

Fireplace inserts, which are radiant room heaters that fit into a fireplace to make them operate more like a woodstove, have become quite popular. With this increased popularity has come greater concern over unsafe conditions in some installations. The two most obvious problems are the formation of creosote in the flue system above the insert and the related chimney fire potential, and the increased thermal hazard to surrounding combustibles presented by the use of an insert in a masonry or factory-built fireplace. As part of its program for DOE, NBS has provided grants to Auburn University and to Underwriters Laboratories to study the fire safety of fireplace inserts. The results of these studies will provide the basis for test standards and building codes to be formulated to ensure the safe utilization of this new type of appliance.

Future work will address specific areas of research including chimney creosoting and chimney fires, protective devices used to allow reduced clearances, and fireplace inserts. The research is expected to lead to recommended modifications to the appropriate model codes, to improved installation guidelines, and to the preparation of manuals of recommended practices for the safe and optimum use of wood as an energy resource.



Creosote and soot deposits in a chimney section being tested to study the intensity of chimney fires.

References

A list of NBS wood-heating safety reports that are available from the researcher:

Peacock, R. D., A Review of Fire Incidents Related to Wood-Burning Appliances, Reprint from Proceedings of Wood Heating Seminar IV, Portland, Oregon, March 21-24, 1979.

Peacock, R. D., A Review of Fire Incidents, Model Building Codes, and Standards Related to Wood-Burning Appliances, National Bureau of Standards Report NBSIR 79-1731 (April 1979).

Shelton, J. W., Analysis of Fire Reports on File in the Massachusetts State Fire Marshal's Office Relating to Wood and Coal Heating Equipment, contract to the National Bureau of Standards, NBSGCR 78-149 (November 1978).

Peacock, R. D., Ruiz, E., and Torres-Pereira, R., Safety of Wood-Burning Appliances, Part I: State of the Art Review and Fire Tests, Volumes I and II, National Bureau of Standards Report NBSIR 80-2140 (November 1980).

Maxwell, T. T., Dyer, D. F., Maples, G., and Burch, T., Fire Safety of Wood-Burning Appliances, Part II: Fireplace Inserts, A Design Review, contract to the National Bureau of Standards, NBSGCR 80-292 (November 1980).

Future reports will deal with other areas of research including chimney creosoting and chimney fires, protective devices used to allow reduced clearances, and fireplace inserts.

A standardized fuel source—wood "brands"—being loaded into a stove during investigations of clearances to combustibles.

FLUIDIC TEMPERATURE SENSORS

The Ceramics, Glass, and Solid State Science Division of NBS, in cooperation with the Harry Diamond Laboratories (HDL) of the U.S. Army and two ceramic processing firms, is developing prototype designs, materials, and fabrication procedures for fluidic temperature sensors to be used in industrial furnaces and forges. These sensors and instrumentation were featured recently in Industrial Research & Development *(May 1980),* Chemical Engineering Magazine *(July 1980), and* Hydraulics and Pneumatics *(September 1980). NBS is responsible for all aspects of materials selection and evaluation relating to the contact sensor for the new devices.*

Taki Negas, Ceramics, Glass, and Solid State Science Division, B214 Materials Building, 301/921–2842.

In principle, operation of the fluidic sensor is analogous to that of an electronic resistance thermometer. A working gas, compatible with the construction materials, is passed through the sensor unit which contains a capillary ($<$ 0.7 mm diameter, $<$ 25 mm length) that is at an elevated temperature. The capillary functions as a variable fluid flow resistor, the resistance depending on working gas and temperature. If the flow to the capillary is constant (e.g., 10^{-6} m^3/s for air), the variation of fluid viscosity with temperature changes generates small pressure changes ($<$ 1.0 Pa) at the capillary input. The device, which has no moving parts, utilizes laminar flow fluidic circuitry to regulate flow and to amplify minute pressure signals so that output may be read with conventional pressure gages and/or pressure transducers.

Design concepts for fluidic instrumentation have been developed at HDL for temperature measurements within numerous environments (e.g., molten metals, vacuum, molten oxides, and forging furnaces). Major improvements incorporated recently include internal set point flow

calibration and leak detection, miniaturization of components, and digital readout of temperature. NBS is considering several classes of materials for the sensing element to cover a large number of potential applications. These include ceramic oxides; refractory metals such as molybdenum (Mo), tungsten (W), and tantalum (Ta); graphite; and various coatings, cermets, and composites.

In cooperation with L. P. Domingues, an NBS guestworker from Trans-Tech, Inc., cylindrical probes up to 60 cm in length and with outer diameters of 1.25 to 2.5 cm are being designed and fabricated from alumina, spinel ($MgAl_2O_4$), and zirconia-yttria solid solutions. These probes are unique in having a monolithic construction consisting of two or four lengthwise parallel channels (up to 6.4 mm diameter), terminating near a closed "sensing" end. At least two of these bores are connected by a capillary at this end. Several of these sensors were installed within U.S. Army rotary hearth forge furnaces ($<$ 1400 °C) and have accumulated over 10 000 hours of thermal history to date without failure.

Sensor output ultimately will be interfaced directly with existing pneumatic furnace controls to eliminate complex electronic-pneumatic signal conversions.

Sensors have been designed and fabricated from molybdenum, tantalum, and graphite. The Mo-probes were coated with silicides and oxides to protect against external oxidation. Nitrogen is used as the internal working fluid. These probes were evaluated from continuous measurements within molten iron (1200–1600 °C) and were tested in cooperation with the General Motors Research Labs, Warren, Michigan. Figure 1 shows a coated Mo-probe that operated nearly 6 hours within molten iron. During the melting operation, a corrosive slag composed of oxides of Fe, Mn, and Si accumulates at the surface of the iron melt. Failure of the sensor occurs when this slag fluxes the oxide coating to expose the underlying molybdenum, which then alloys with the molten iron. Methods are under investigation to diminish corrosion rates sufficiently to extend probe durability to about 16 hours.

Metal-based sensors and instrumentation have been requested by many companies to measure temperature within environments including, for example, molten oxides (1700–2000 °C) used to fabricate fusion cast refractories, vacuum furnaces (1800 °C) used to prepare dielectric materials, chemical processing in a chlorine-rich atmosphere (1000 °C), and nuclear reactors as part of a redundant nonelectrical sensing system. Researchers at the Sandia Laboratories are simulating nuclear meltdown phenomena using molten uranium oxide plus lanthanum oxide mixtures (2000–2600 °C) and molten steel. High temperature, large induction fields, and the geometry of their testing apparatus preclude conventional thermocouple and pyrometric temperature measurements.

NBS, HDL, and Sandia will collaborate to measure temperature using fluidic sensors constructed from tantalum (possibly coated with tungsten) and tungsten. Negotiations also are in progress with the Department of Energy to perform measurements at a solar energy laboratory, to demonstrate applications for fossil fuel technologies, and to provide a technical data package for industries that may wish to manufacture and market the device.

Figure 1—A molybdenum fluidic temperature sensor, coated with spinel ($MgAl_2O_4$), within molten grey iron plus slag at the General Motors Research Facility.

CONFERENCES

For general information on NBS conferences, contact JoAnn Lorden, NBS Public Information Division, Washington, DC 20234, 301/921-2721.

CONFERENCE ON CRYOGENIC ENGINEERING

"Cryogenics—An Essential Foundation for Advanced Technology" will be the theme of the 1981 Cryogenic Engineering Conference (CEC) to be held August 10–14, 1981, at the Town and Country Motel, San Diego, California. The Boulder, Colorado, Laboratory of the National Bureau of Standards serves as the secretariat for the CEC.

Because of many common interests, the CEC will be held in parallel with the International Cryogenic Materials Conference (ICMC) and an industrial exhibition sponsored by the Cryogenic Society of America.

The CEC will include all aspects of cryogenic engineering; the ICMC will include all aspects of material technology and material properties at low temperatures. Papers are now being solicited for both meetings. The conference sponsors are particularly interested in papers related to trends and future applications. Contributions which survey the work of a number of collaborators from the same institutions or which review contemporary research areas are also welcome.

Papers delivered during the regular sessions of the conferences will be limited to 25 minutes; there will also be poster presentations. All accepted abstracts will appear in the conference program, and manuscripts of all presentations will be submitted for review and possible publication in the conference proceedings.

Interested authors should submit five copies of a 50-word abstract and a 400-word summary by March 1, 1981. CEC contributions should be sent to Carl D. Henning, Lawrence Livermore Laboratory, P.O. Box 808, L-541, Livermore, CA 94550. ICMC contributions should be sent to J. W. Morris, Jr., Department of Material Science, University of California, Berkeley, CA 94720.

Oral and poster presentations will be selected by the editors for publication in *Advances in Cryogenic Engineering* on the basis of quality and relevancy.

Thomas M. Flynn of the NBS Thermophysical Properties Division is the CEC Chairman. For general conference information, contact Dee Belsher, CEC Admintrator, Program Information Office, National Bureau of Standards, 325 Broadway, Boulder, CO 80303 or phone 303/497-3981 (FTS 320-3981).

CONFERENCE CALENDAR

March 2-4
MEASUREMENT OF ELECTRICAL QUANTITIES IN PULSE POWER SYSTEMS, NBS, Boulder, CO; sponsored by NBS; contact: Ronald McKnight, B344 Metrology Building, 301/921-3121.

March 17-18
SECOND CONFERENCE ON CONSUMER PRODUCT STANDARDS, NBS, Gaithersburg, MD; sponsored by NBS and ASTM; contact: Walter Leight, 111 EM Building, 301/921-3750.

April 6-10
6TH INTERNATIONAL SYMPOSIUM ON NOISE IN PHYSICAL SYSTEMS, NBS, Gaithersburg, MD; sponsored by NBS and the Catholic University of America; contact: Robert J. Soulen, B128 Physics Building, 301/921-2018.

April 21-24
MECHANICAL FAILURES PREVENTION GROUP, NBS, Gaithersburg, MD; sponsored by NBS and MFPG; contact: H. Burnett, B266 Materials Building, 301/921-2992.

April 30-May 1
NATIONAL ROOFING TECHNOLOGY CONFERENCE, NBS, Gaithersburg, MD; sponsored by NBS and NRCA; contact: Robert Mathey, B348 Building Research Building, 301/921-2629.

June 1-3
6TH INTERNATIONAL SYMPOSIUM ON IMAGING AND ULTRASONIC TISSUE CHARACTERISTICS, NBS, Gaithersburg, MD; sponsored by NBS, NIH, IEEE, and AIUM; contact: Melvin Linzer, A366 Materials Building, 301/921-2611.

June 8-12
SECOND INTERNATIONAL CONFERENCE ON PRECISION MEASUREMENTS AND FUNDAMENTAL CONSTANTS, NBS, Gaithersburg, MD; sponsored by NBS, IUPAP, and AMCO; contact: Barry N. Taylor B258 Metrology Building, 301/921-2701.

June 15-19
INTERNATIONAL JOINT CONFERENCE ON THERMOPHYSICAL PROPERTIES, NBS, Gaithersburg, MD; sponsored by NBS, ASME, and Purdue University; contact: A. Cezairliyan, Room 124 Hazards Building, 301/921-3687.

June 18
20TH ANNUAL ACM SYMPOSIUM, UNIVERSITY OF MARYLAND, College Park, MD; sponsored by NBS and ACM; contact: Wilma Osborne, A265 Technology Building, 301/921-3485.

***August 10-14**
CRYOGENICS—AN ESSENTIAL FOUNDATION FOR ADVANCED TECHNOLOGY, San Diego, CA; sponsored by NBS, and Cryogenic Engineering Conference; contact: Dee Belsher, Program Information Office, Room 4001-Building 1, Boulder, CO 80303, 303/497-3981.

September 14-16
SECOND INTERNATIONAL CONFERENCE ON THE DURABILITY OF BUILDING MATERIALS AND COMPONENTS, NBS, Gaithersburg, MD; sponsored by NBS, ASTM, NRC of Canada, International Council for Building Research Studies and Documentation, International Union of Testing and Research Laboratories for Materials and Structures; contact: Geoffrey Frohnsdorff, B348 Technology Building, 301/921-3485.

*New Listings

PUBLICATIONS

HANDBOOK FOR FIRE INVESTIGATORS

*Brannigan, F. L., Ed., University of Maryland Fire and Rescue Institute, Bright, R. G., and Jason, N. H., Eds., Fire Investigation Handbook, Nat. Bur. Stand. (U.S.), Handb. 134, 197 pages (Aug. 1980) Stock No. 003-003-02223-3, $8.**

Fire has broken out in an office. Papers atop desks and cabinets quickly flare up. A hot fire plume lifts and scatters these burning papers to different parts of the room. If the fire department arrives at this point, it may suspect that there were several fires and that the fires were intentionally set . . .

According to the *Fire Investigation Handbook* just published by NBS, a discerning on-the-scene investigator would first consider what types of materials were involved in the fire and their likely behavior under fire conditions before jumping to any conclusions about the possibility of arson.

For fire investigators of all levels of experience from beginners to seasoned veterans, the illustrated 197-page NBS handbook deals with typical, widely varying situations daily confronting fire investigators. The evidence to be gathered is often complex, sometimes deceptive, and—if arson is suspected—must be handled and protected with special care for eventual court presentation. Cooperatively compiled and edited by Francis L. Brannigan, on adjunct staff at the University of Maryland Fire and Rescue Institute, and Richard G. Bright and Nora H. Jason of the NBS Center for Fire Research, the handbook offers step-by-step investigative guidelines and a comprehensive discussion of fire investigation complexities.

Principal subject areas covered by the handbook are: fire ground procedures, post-fire interviews, the building and its makeup, ignition sources, the chemistry and physics of fire, and sources of information. Appendices cover topics of how to organize an arson task force, the role of the expert witness, and independent testing laboratories.

Practical instructions are included on needed tools and equipment; chemical detection of combustible liquids and other fire "accelerants" used by arsonists; developing eyewitness information; gathering, marking, and safeguarding evidence; fire investigation photography; fire investigation recordkeeping; sources of information, and legal problems.

** Publications cited here may be purchased at the listed price from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 (foreign: add 25 percent). Microfiche copies are available from the National Technical Information Service, Springfield, VA 22161. For complete periodic listings of all scientific papers and articles produced by NBS staff, write: Editor, Publications Newsletter, Administration Building, National Bureau of Standards, Washington, DC 20234.*

COMPUTER SOFTWARE CONVERSION

Collica, J., Skall, M., and Bolotsky, G., Conversion of Federal ADP Systems: A Tutorial, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-62, 73 pages (Aug. 1980) Stock No. 003-003-02226-8; $4.

Directed toward better understanding of the conversion of federal automatic data processing systems, a new NBS publication provides a tutorial report that should help to clarify the complex procedures involved. The report was prepared on a three-fold basis: interviews with commercial experts, interviews with Government agency personnel who have recently had systems converted, and current literature. The first three chapters in *Conversion of Federal ADP Systems: A Tutorial* (SP 500-62) comprise the tutorial; the next three chapters discuss the information gathered; and the last chapter focuses on major problems with a summation of the authors' conclusions.

USER-COMPUTER INTERACTION LANGUAGES

Treu, S., A Testbed for Providing Uniformity to User-Computer Interaction Languages, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-63, 74 pages (Aug. 1980) Stock No. 003-003-02234-9; $4.

To help remove stumbling blocks in the way of user-computer interaction languages, NBS reports in a new publication on use of an intermediary processor to "uniformize" interaction languages. The processing framework is characterized in terms of the required intermediary actions and the logical capabilities needed to perform those actions. Centering on the NBS Network Access Machine, descriptions of the testbed software facilities are detailed. Throughout the report, entitled *A Testbed for Providing Uniformity to User-Computer Interaction Languages* (SP 500-63), example applications are included.

MAGNETIC FUSION ENERGY APPLICATIONS

Reed, R. P., Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures-III, Nat. Bur. Stand. (U.S.), NBSIR 80-1627, 396 pages (Aug. 1980). Order by Stock No. PB 80-191497 from National Technical Information Service, Springfield, VA 22161; $20.

The National Bureau of Standards has released a report, *Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures-III* (NBSIR 80-1627), describing activities of a low temperature materials research project during its third year. This work centered mainly on measurement of the mechanical and physical properties of stainless steel from room temperature to liquid helium temperature. Aluminum alloys were also studied, and work was done on the characterization and standardization of industrial composites.

The data reported will aid in the de-

sign and development of cryogenic structures for superconducting magnets used in fusion energy power plants and prototypes. The project was sponsored by the U.S. Department of Energy's Office of Fusion Energy and managed by the Fracture and Deformation Division of NBS. Some of the research was carried out at other laboratories through subcontracts with NBS.

LABORATORY PERFORMANCE EVALUATION

Berman, G. A., Ed., Testing Laboratory Performance: Evaluation and Accreditation, Nat. Bur. Stand. (U.S.), Spec. Publ. 591, 179 pages (Aug. 1980) Stock No. 003-003-02229-2, $5.50.

Techniques for appraising testing laboratories' effectiveness are scrutinized by 29 specialists in *Testing Laboratory Performance: Evaluation and Accreditation* (SP 591), a new publication of the National Bureau of Standards.

Comprising papers presented at a "National Conference on Testing Laboratory Performance: Evaluation and Accreditation" sponsored by the NBS Office of Testing Laboratory Evaluation Technology, the publication deals with leading topics including:

- Overview of evaluation and accreditation
- Evaluating technology
- Health services accreditation programs
- Accreditation systems and concepts
- Quality control
- Evaluation programs and systems
- International coordination

PUBLICATIONS LISTING

Acoustics and Sound

Donavan, P. R., Flynn, D. R., and Yaniv, S. L., Highway Noise Criteria Study: Outdoor/Indoor Noise Isolation, Nat. Bur. Stand. (U.S.), Tech. Note 1113-2, 180 pages (Aug. 1980) Stock No. 003-003-02235-7, $6.

Analytical Chemistry

Menis, O., Rook, H. L., and Garn, P. D., The State-of-the-Art of Thermal Analysis: Proceedings of a Workshop held at the National Bureau of Standards, Gaithersburg, MD, May 21-22, 1979, Nat. Bur. Stand. (U.S.), Spec. Publ. 580, 265 pages (Aug. 1980) Stock No. 003-003-02219-5, $7.

Atomic and Molecular Studies

Miller, B. J., Fuhr, J. R., and Martin, G. A., Bibliography on Atomic Transition Probabilities (November 1977 through March 1980), Nat. Bur. Stand. (U.S.), Spec. Publ. 505-1, 121 pages (Aug. 1980) Stock No. 003-003-02230-6, $4.50.

Building Technology

Weidt, J. L., Saxler, R. J., and Rossiter, W. J., Jr., Field Investigation of the Performance of Residential Retrofit Insulation, Nat. Bur. Stand. (U.S.), Tech. Note 1131, 67 pages (Sept. 1980) Stock No. 003-003-02243-8, $3.75.

Computer Science and Technology

Collica, J. C., Skall, M. W., and Bolotsky, G. R., Conversion of Federal ADP Systems: A Tutorial, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-62, 73 pages (Aug. 1980) Stock No. 003-003-02226-8, $4.

Gait, J. Maintenance Testing for the Data Encryption Standard, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-61, 29 pages (Aug. 1980) Stock No. 003-003-02225-0, $2.

Kaetzel, L. J., Glass, R. A., and Smith, G. R., A Computer Data Base System for Indexing Research Papers, Nat. Bur. Stand. (U.S.), Tech. Note 1123, 90 pages (Oct. 1980) Stock No. 003-003-02245-4, $4.25.

Treu, S., A Testbed for Providing Uniformity to User-Computer Interaction Languages, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-63, 74 pages (Aug. 1980) Stock No. 003-003-02234-9, $4.

Health and Safety

Meese, W. J., and Beausoliel, R. W., Evaluation of Electrical Connections for Branch Circuit Wiring, Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 128, 71 pages (Nov. 1980) Stock No. 003-003-02269-1, $4.

Energy Conservation and Production

Arens, E. A., Flynn, L. E., Nall, D. N., and Ruberg, K., Geographical Extrapolation of Typical Hourly Weather Data for Energy Calculation in Buildings, Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 126, 121 pages (Aug. 1980) Stock No. 003-003-02228-4, $4.50.

Didion, D., Garvin, D., and Snell, J., A Report on the Relevance of the Second Law of Thermodynamics to Energy Conservation, Nat. Bur. Stand. (U.S.), Tech. Note 1115, 51 pages (Aug. 1980) Stock No. 003-003-02231-4, $3.25.

Engineering, Product, and Information Standards

Berman, G. A., Ed., Testing Laboratory Performance: Evaluation and Accreditation. Proceedings of a National Conference held at the National Bureau of Standards, Gaithersburg, MD, Sept. 25-26, 1979, Nat. Bur. Stand. (U.S.), Spec. Publ. 591, 179 pages (Aug. 1980) Stock No. 003-003-02229-2, $5.50.

Leedy, K. O., Catalog of Federal Metrology and Calibration Capabilities, Nat. Bur. Stand. (U.S.), Spec. Publ. 546, 1980 Edition, 60 pages (Sept. 1980) Stock No. 003-003-02251-9, $4.

Failure Analysis

Becker, D. A., and Comeford, J. J., Recycled Oil Program: Phase I—Test Procedures for Recycled Oil Used as Burner Fuel, Nat. Bur. Stand. (U.S.), Tech. Note 1130, 93 pages (Aug. 1980) Stock No. 003-003-02227-6, $4.25.

Properties of Materials: Structural and Mechanical

Morris, M. C., McMurdie, H. F., Evans, E. H., Paretzkin, B. S., Hubbard, C. R., and Carmel, S. J., Standard X-Ray Diffraction Powder, Patterns. Section 17—Data for 54 Substances, Nat. Bur. Stand. (U.S.), Monogr. 25, Sec. 17, 114 pages (Oct. 1980) Stock No. 003-003-02253-5, $4.50.

Thermodynamics and Chemical Kinetics

Sengers, J. V., and Klein, M., Eds., The Technological Importance of Accurate Thermophysical Property Information. Proceedings of a Session of the Winter Annual Meeting of the American Society of Mechanical Engineers held in New York, NY, December 6, 1979, Nat. Bur. Stand. (U.S.), Spec. Publ. 590, 56 pages (Oct. 1980) Stock No. 003-003-02244-6, $3.75.

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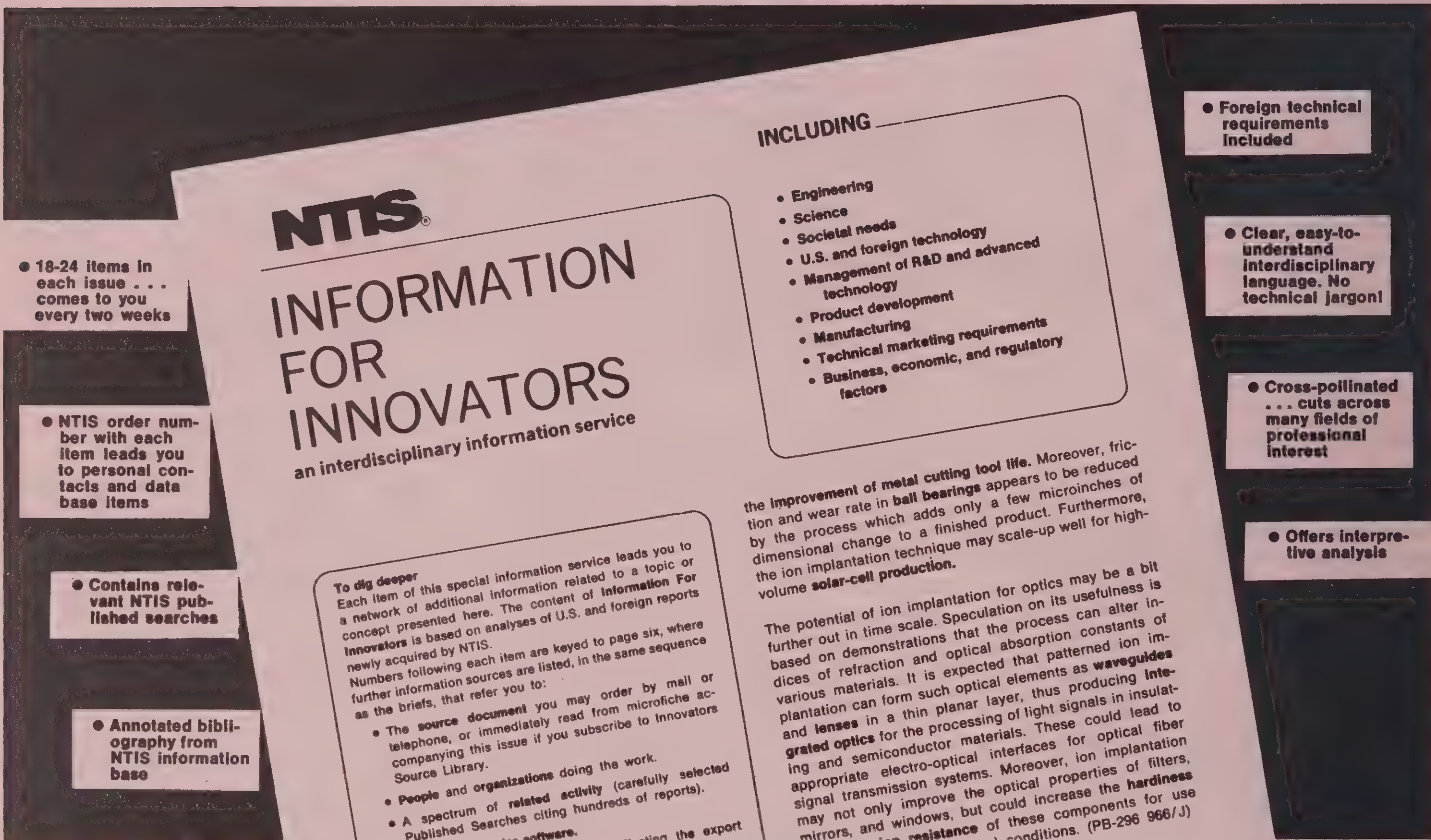

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DIMENSIONS NBS

Volume 64, 1980

A-B

C-D

E-F-G

H-I

J-K-L

M-N-O

P-Q-R

S-T

U-V-W

X-Y-Z

NEWS BRIEFS

DETECTION OF COMBUSTION REACTION INTERMEDIATE. A new system for observing an important reaction intermediate (CH_2OH) of hydrocarbon combustion and coal gasification has been developed by NBS researchers. Because CH_2OH is highly reactive, it is usually present in amounts too small to be detected. The NBS researchers have devised a way to trap concentrated samples of CH_2OH, produced from methanol, in solid argon at 14 K. Observing CH_2OH in this form, NBS researchers have successfully identified six of the nine major vibrational frequencies for the molecule. This information should speed development of sensitive coal gasification processes.

NVLAP TO ACCEPT ACCREDITATION APPLICATIONS ANY TIME. Testing laboratories seeking accreditation under the Commerce Department's National Voluntary Laboratory Accreditation Program (NVLAP) may now make application at any time during the year for initial entry into NVLAP, for additional laboratory accreditation programs, and for additional test methods within those programs. NVLAP will review applications and initiate laboratory assessments, carried out by NBS, on a continual basis. The changes are intended to make NVLAP more responsive to the needs of testing laboratories.

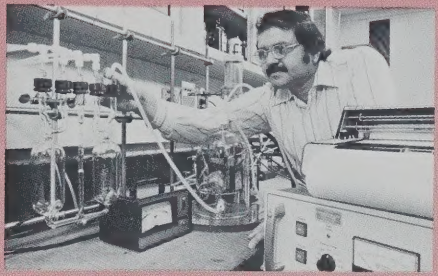
BENCH-SCALE UNIT SET UP FOR COMBUSTION OF SOLID INDUSTRIAL FUELS. The Continuous Process Technology Program's Thermal Processes Division set up and demonstrated the capability of a new bench-scale unit for combustion of solid fuels. The unit can be used as either a fluid-bed or an entrained-flow combustor. In either mode, the unit provides controlled environment for combustion of solid particles: temperatures up to 2000 °F (about 1090 °C), flow velocities up to 3 ft/s (1 m/s), and wide variability of gas composition (O_2, H_2, CO_2, N_2). The facility will be used for combustion research on solid industrial fuels: coals, refuse-derived fuels, and wood.

RADIOACTIVITY STANDARDS FOR NUCLEAR MEDICINE. Between February and July 1981 NBS will have available the following SRM's for use in verifying the activity levels of radiopharmaceuticals: SRM 4401L-G Iodine-131, SRM 4412L-F Molybdenum-99, SRM 4415L-E Xenon-133, SRM 4404L-D Chromium-51. For further information and current prices, call or write to Nancy Walley, Radioactivity Group, C114 Radiation Physics Building, National Bureau of Standards, Washington, DC 20234, or phone 301/921-2665.

SECOND YEAR OF NBS REFERENCE DATA GRANTS PROGRAM UNDER WAY. The National Bureau of Standards is soliciting project proposals for an interagency grants program to encourage the gathering and evaluation of useful scientific reference data. Now in its second year, the program is administered by the Bureau's Office of Standard Reference Data. It will award nearly $500,000 in grants funded by NBS, the National Science Foundation, the Department of Energy, and the Office of Naval Research. The closing date for receipt of proposals is February 15, 1981. The program is intended to foster the competent, critical evaluation of published data, with emphasis on reviews of experimental procedure, analyses of sources of error, and, where possible, extrapolations from the known data. Further information can be obtained from the Office of Standard Reference Data, National Bureau of Standards, Washington, DC 20234, or telephone 301/921-2467.

NEXT MONTH IN

DIMENSIONS NBS



How do we determine whether the air we breathe is "clean"? In the next issue of DIMENSIONS we will share with you some results from an NBS program to evaluate air sampling devices for personal monitoring of pollution.

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The Commerce Department's National Bureau of Standards was established by Congress in 1901 to advance the Nation's science and technology and to promote their application for public benefit. NBS research projects and technical services are carried out by the National Measurement Laboratory, the National Engineering Laboratory, and the Institute for Computer Sciences and Technology. Manufacturing, commerce, science, government, and education are principal beneficiaries of NBS work in the fields of scientific research, test method developments, and standards writing. DIMENSIONS/NBS describes the work of NBS and related issues and activities in areas of national concern such as energy conservation, fire safety, computer applications, materials utilization, and consumer product safety and performance. The views expressed by authors do not necessarily reflect policy of the National Bureau of Standards or the Department of Commerce.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Annual subscription: Domestic, $11.00, foreign, $13.75. Single copy: $1.10, foreign, $1.40. The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget though June 30, 1981.

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